ANSI B74.18-1996
Revision of ANSI B74.18-1984

For Grading of Certain Abrasive Grain on Coated Abrasive Material

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ANSI B74.18-1996

ANSI American National Standards Institute
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American National Standard

for Grading of Certain Abrasive Grain on Coated Abrasive Material

Secretariat
Grinding Wheel Institute

Approved September 23, 1996
American National Standards Institute, Inc.

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Foreword

(This Foreword is not a part of ANSI Specification for Grading of Certain Abrasive Grain on Coated Abrasive Products.)

History Of Project

First Edition

The first published standard was issued by the U. S. Department of Commerce, office of Technical Services and the Commodity Standards Division. In establishing a Commercial Standard for the Grading of the Abrasive Grain on coated abrasive sheets, belts, discs, rolls and similar products, department cooperation was requested by the Coated Abrasive Manufacturers' Institute on June 27, 1957. After review by the National Bureau of Standards, a draft submitted by the Institute was modified, and a proposed Commercial Standard was mailed to all manufacturers and to selected users, testing laboratories, and Government agencies on May 5, 1958, for advance comment. Further minor adjustments were made and a Recommended Commercial Standard was widely circulated to producers, distributors, users, and testing laboratories for consideration and final approval on November 26, 1958. Sufficient endorsements in the form of signed acceptances from individual organizations were received to insure the successful application of the new standard. Accordingly, the establishment of Commercial Standard CS217-59, to be effective for new production from March 18, 1959.

Revisions

On August 7, 1964, the Coated Abrasive Manufacturers' Institute (CAMI), requested a revision of CS217-59, and submitted a list of the suggested changes. Additional suggestions were offered by the National Bureau of Standards. A Proposed Revision of the Standard, TS5674 was prepared by Products Standards Section and was distributed to all producers of abrasive grain and of coated abrasive products, to the Standing Committee, and to testing laboratories for consideration. Minor adjustments were made based on the comment received, and on August 10, 1966, a Recommended Product Standard was widely distributed to the industry for acceptance. A public notice was issued to the technical trade press.

Endorsements in the form of signed acceptance sheets were received from individual producers who represented, according to the CAMI, approximately 90% of the abrasive grain, and of the coated abrasive product production. Many coated abrasive product distributors, users, testing laboratories, and government interests also filed acceptances. These endorsements were considered to represent a reasonable consensus and there were no objections to the proposal. Accordingly, the approval for publication of Product Standard PS8-67 for Grading of Abrasive Grain on Coated Abrasive Products, was announced on December 9, 1966, to become effective for new production on January 9, 1967.

Subsequent changes saw (1) the establishment of a single set of standard accumulation curves for all waterproof and non-waterproof sedimation grit sizes (micro-grits) of abrasive grain, (2) the establishment of grading limits for both screen and sedimentation grit sizes of lint (pouncing paper) and flint (snuffing paper), and (3) making the grading limits for the sedimentation sizes of flint (finishing paper) consistent with those of the other abrasive grains. The full range of grit sizes for garnet were also included.

The initial ANSI Standard for Coated Abrasive grit sizes was further simplified and changed from its predecessor PS-8 in the following ways:

1. Screen grit sizes. The duplication of standard sands for a specific grit was eliminated; i.e.; the one sand now applies to all types of mineral, be it garnet, aluminum oxide, silicon carbide, or flint.

The discontinued standard sands are:

Grit Size	180 Std. Sand dated 8/05/52
	120 Std. Sand dated 2/20/51
	100 Std. Sand dated 4/16/54
	80 Std. Sand dated 11/24/52
	36 Std. Sand dated 6/30/55
	30 Std. Sand dated 3/01/56
	24 Std. Sand dated 5/09/52
	20 Std. Sand dated 7/27/55
	16 Std. Sand dated 3/00/32

The following list of standards will replace those that were discontinued, for use on all minerals; i.e., aluminum oxide, garnet, flint, silicon carbide, and zirconia-alumina.

Grit Size	180 Std. Sand dated 7/01/52
	120 Std. Sand dated 4/21/55
	100 Std. Sand dated 4/20/50
	80 Std. Sand dated 4/20/50
	36 Std. Sand dated 6/00/43
	30 Std. Sand dated 10/25/49
	24 Std. Sand dated 6/24/54
	20 Std. Sand dated 11/00/41
	16 Std. Sand dated 6/11/52

2. The collecting tube for the determination of sedimentation grit sizes (microgrits) was further defined.

3. The sedimentation medium was changed from a blend of natural and synthetic methanol, to a synthetic methanol with a controlled water content. A change in dispersant was made.

4. Metric nomenclature was incorporated into the specification.

Previous current drafts were prepared and approved by the Coated Abrasive Manufacturers' Institute. The documents were then submitted to Subcommittee No. 4 on Coated Abrasives for approval. Approval was obtained from the Subcommittee and the proposed standard was submitted to the full ANSI Standards Committee on Abrasives, B74. The B74 Committee approved the document. Final approval was granted by the American National Standards Institute on January 27, 1984.

Primary changes to the current 1996 edition are (1) the incorporation of the ROTAP as an equivalent grading system for macrogrits using the standard sands to provide grading reference, (2) the addition of a premium minerals (zirconia-alumina), (3) the establishment of grading standards to cover the premium mineral, and (4) the introduction of an electrical resistance method for microgrit particle size distribution. Final approval was granted by the American National Standards Institute on ____, 1996.

Additions and revisions which may be necessary in the future will be considered by ANSI Standards Committee, B74, which represents a cross section of those interested in abrasives. Suggestions for improvement gained in the use of this standard should be sent to the American National Standards Institute, 11 West 42nd St., New York, NY 10036.

The ANSI Standards Committee on Abrasives, B74, which reviewed and approved this standard had the following personnel at the time of approval:

Richard S. Meyer, Chairman
J. J. Wherry, Secretary

Organization Represented	*Name of Representative*
Abrasive Grain Association	Martin G. Wozniak
	J. J. Wherry (Alt.)
American Institute of Chemical Engineers	J. H. Sterne, III
Cemented Carbide Producers Association	Joe J. Ley
	J. J. Wherry (Alt.)
Coated Abrasives Manufacturers' Institute	D. E. Williams
	C. M. Stockinger (Alt.)
Compressed Air & Gas Institute, Pneumatic Tool Section	Robert A. Pennison
	Duane Bookshar (Alt.)

Diamond Wheel Manufacturers Institute	J. H. Kilmer
	J. J. Wherry (Alt.)
General Services Administration	Steve Hooper
Grinding Wheel Institute	Richard S. Meyer
	J. J. Wherry (Alt.)
Industrial Diamond Association of America, Inc.	Fred Gray
Institute for Advanced Manufacturing Sciences	John Pfeiffer
Power Tool Institute, Inc.	Steven Hackey
	Charles M. Stockinger (Alt.)
Society of Carbide and Tool Engineers	Joseph E. Freiland
United States Cutting Tool Institute	Charles M. Stockinger
University of Massachusetts	John E. Ritter, Jr.

The personnel of Subcommittee No. 4 on Coated Abrasives were as follows:

David E. Williams, Chairman

I. S. Hong
D. Potter
K. Stafflinger

American National Standard
for Grading of Certain Abrasive Grain on

Coated Abrasive Material

1 Purpose

The purpose of this American National Standard is to provide a nationally recognized standard for the grading by particle size of certain abrasive grain on coated abrasive products such as sheets, belts, bands and discs. The Standard also serves as a basis for understanding between purchasers and sellers as to the particle size desired or supplied.

2 Scope

This Standard specifies: (1) grading requirements for the screen grit sizes and the sedimentation grit sizes of aluminum oxide, zirconia-alumina, silicon carbide, garnet, emery and flint abrasive grains for use on coated abrasive products, (2) procedures for recovery of the abrasive grains from the products to be tested, and (3) procedures for testing the recovered abrasive grains to determine if they conform to the grading requirements. Definitions of the trade terms used and methods for identifying products which conform to this Standard are included.

3 Classification and Definitions

3.1 Classification

Coated abrasive grains fall into two general size classifications: screen grit sizes and sedimentation grit sizes. Those which are coarse enough to be measured and controlled by the use of sieves are called "screen grit sizes"; those which are so fine that they have to be measured and controlled either by a sedimentation method based on Stokes Law or an electrical resistance method (Coulter Counter), are called " sedimentation grit sizes: (microgrits)."

This American National Standard covers the grit sizes of the several kinds of abrasive grain as indicated in table 1.

3.1.2 Exceptions

3.1.2.1. Emery Polishing Paper

The emery listed here does not include emery polishing paper which is commonly called French Emery Paper.

3.1.2.2 Crocus Cloth

Crocus cloth is a coated abrasive which has an abrasive grain coating consisting essentially of ferric oxide. Abrasive grain size shall be as specified in Commercial Item Description A-A-1206.

Table 1 - Classification of Abrasive Grain for Coated Abrasive Products

Screen grit sizes	
Kind of abrasive grain	grit sizes
Aluminum oxide, Garnet, Silicon Carbide, Zirconia-Alumina	220 through 12
Flint	220, 180, 150
Emery	Fine through Extra Coarse
Flint	Extra Fine through Extra Coarse
Sedimentation and Electrical Resistance grit sizes (Microgrits)	
Kind of abrasive grain	Grit sizes
Aluminum oxide, Garnet, Silicon Carbide, Flint	600 through 240

3.2 Product Definitions
The trade terms used herein and their definitions are as follows:

3.2.1 Backing: The backing refers to the substrate onto which the minerals are bonded. This substrate can be paper, cloth, fiber or combination thereof.

3.2.2 Bonds: In the manufacture of coated abrasives, a layer of adhesive called the making coat is first applied to the backing. The abrasive grain is then deposited and a second layer of adhesive called the sizing coat is then applied over the abrasive grain. The combination of making and sizing coats is referred to as the bond and different types of bonds as described below require different recovery procedures:

3.2.2.1 Glue Bond: A type of bond in which both the making coat and sizing coat consist of animal hide glue which is completely soluble in water. Either or both adhesive coats may contain mineral filler.

3.2.2.2 Resin-over-glue Bond: A type of bond in which the making coat consists of a type of adhesive which is water soluble or is softened in water and the sizing coat consists of a resin which is insoluble in readily available solvents such as water, alcohol, or caustic. Either or both adhesive coats may contain a mineral filler.

3.2.2.3 Resin-over-resin Bond: A type of bond in which both the making coat and sizing coat consist of a resin which is insoluble in readily available solvents such as water, alcohol, or caustic. Either or both adhesive coats may contain a mineral filler.

3.2.2.4 Waterproof Bond: A type of bond which is applied to a waterproof type backing and in which both the making and sizing coats consists of a resin or varnish which is insoluble in water. Such bonds fall into two classifications: those consisting of adhesives which are soluble in readily available solvents such as alcohol or caustic and those which are not. Either or both adhesive coats may contain a

mineral filler.

3.2.3 Grading Definitions

3.2.3.1 Particle Size Distribution: Particle size distribution is the range of the particle sizes within a grit size as expressed by the accumulation curve developed in the sedimentation grading procedure and by the percentages of overgrade, control and fines determined by screen grading.

3.2.4. Sedimentation Grading

3.2.4.1 Accumulation Curve: An accumulation curve is used when grading sedimentation grit sizes; it is the plot of particle size (in micrometers) on the abscissa and height percent on the ordinate. (Example: refer to figure 1, for grit size 320. The 40 height percent represents a grit size of 38.4 micrometers (maximum). This means that 40 percent by volume of the abrasive grain is 38.4 micrometers or larger, the remaining grain is less than 38.4 micrometers in size.)

3.2.4.2 Checking Minerals: The checking minerals consist of two carefully prepared size distributions of silicon carbide abrasive grain numbered 280 and 320. The checking minerals are used to check the sedimentation apparatus, the sedimentation medium, and the testing technique.

3.2.4.3 Height Percentage: In sedimentation grading procedures, height percentage represents the percentage of the total height of the abrasive grain which falls and fills the calibrated sedimentation tube, at any given time, compared to the ultimate total sedimentation height. (For example, 2 millimetres collected at a point in time is 10 percent if the total amount of abrasive grain collected is 20 millimetres at the completion of the procedure.)

3.2.5 Electrical Resistance Method

3.2.5.1 Theory: The electrical resistance test method determines the number and size of particles suspended in an electrically conductive liquid. This is done by forcing the suspension to flow through a small aperture having an immersed electrode on either side. As the particle passes through the aperture, it changes the resistance between the electrodes. This produces a voltage pulse of short duration having a magnitude proportional to particle size. The series of pulses is then electrically scaled and counted.

3.2.5.2 Aperture Tube: The tube to be used for measurement which is selected from Table 13 that gives a range of aperture openings (diameter) in micrometers based upon the range of particle size distribution as expressed as grain size (for example a 240 grit would use a 560 aperture while an 8000 grit would use a 10 aperture.

3.2.5.3 Electrolyte: An electrolyte shall be used as the dispersing agent of a sample. The electrolyte shall be sodium chloride of 1% to 4% concentration or sodium pyrophosphate solution of 4% concentration and filtered. When an aperture tube larger than 50 um is used, the electrolyte shall be filtered two times through a filter of 0.8 um, and when an aperture tube 50 um and smaller is used, two times

Grit Size (Micrometres)												
	240		280		320		360		400		500		600	
Height Percent	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
%														
3	79.5	76.0	73.0	69.5	62.5	59.0	50.0	47.0	40.0	37.0	34.6	32.0	32.0	29.0
10	70.8	67.3	62.0	58.5	52.0	48.5	40.5	37.5	33.3	30.3	28.0	25.2	25.2	22.2
20	64.4	60.9	54.6	51.1	45.3	41.8	35.5	32.5	29.5	26.5	24.5	21.5	20.8	17.8
30	60.0	56.5	50.3	46.8	41.4	37.9	32.6	29.6	27.1	24.1	22.2	19.2	18.5	15.5
40	56.5	53.0	47.0	43.5	38.4	34.9	30.5	27.5	25.2	22.2	20.7	17.7	16.8	13.8
50	53.5	50.0	44.0	40.5	36.0	32.5	28.8	25.8	23.6	20.6	19.7	16.7	16.0	13.0

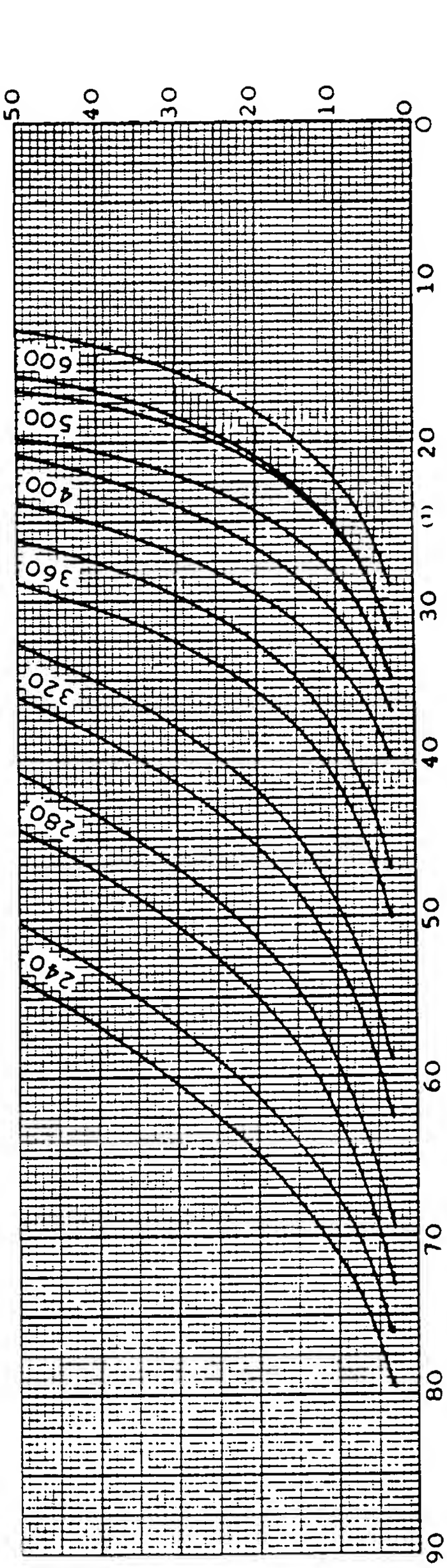

Figure 1

Standard Micrometer Values - (Accumulation Curves) for Sedimentation Grit Sizes
Aluminum oxide, garnet, and silicon carbide 600, 500, 400, 360, 320, 280, 240. Flint 400, 360, 280, 240.

Micro Grit Particle Size Distribtuion values 600 grit and finer, use the Electro Resistance Method, See Appendix 1.

through a filter of 0.2 um. Other commercially made electrolytes may also be used as defined by the equipment manufacturer.

3.2.5.4 Calibration Sample: Latex spheres similar to the true sphere of which the grain size distribution is known shall be used for the calibration of the apparatus. These are available from the instrument manufacturer.

3.2.5.5 Method of Operation - see 6.3.

3.2.5.6 Particle Size Distribution Values - Electrical Resistance Method, See Appendix 1

3.2.6 Screen Grading

3.2.6.1 Standard Sands: Standard sands are used to check the sieving characteristics of the test sieves for the purpose of determining their suitability for use (see 6.1.3.1.), and to provide a reference for determining the grading of abrasive grain recovered from the coated abrasive product. The dates shown in table 3 are dates on which the standard sands became effective. Sands are replenished from time to time and bear both the original date and the replacement date.

3.2.6.2 Overgrade: Overgrade is that percentage of the abrasive grain by weight which remains on the control sieve.

3.2.6.3 Control: Control is that percentage of the abrasive grain by weight which passes through the control sieve but remains on the fines sieve.

3.2.6.4 Fines: Fines is that percentage of the abrasive grain by weight which passes through the fines sieve.

3.2.6.5 Coarseness of Total Grit Size: The coarseness of total grit size is that portion (percentage) of the abrasive grain by weight (consisting substantially of the entire sample) which passes through the coarse sieves; i.e., sieves through which 100% or 99.5% shall pass.

4 Grading Limits (Requirements)

4.1 Screen Grit Sizes

The particle size distribution of an abrasive grain classified as a screen grit size abrasive shall be determined by testing both the abrasive grain recovered from the coated product and the appropriate standard sand with the same sieves according to the procedure described in section 6.1 and comparing the results. The abrasive grain shall be recovered from the coated product as described in 5.1. The recovered abrasive grain shall meet the grading limits specified in 4.1.1, 4.1.2, and 4.1.3.

4.1.1 Coarseness of Total Grit Size

The coarseness of the total grit size of the abrasive grain recovered from the coated product shall satisfy the requirements contained in table 2.

4.1.2 Overgrade

For aluminum oxide, garnet, and silicon carbide abrasive grain, the overgrade percentage of the test sample shall not exceed 6/5 (1.2) times the overgrade percentage of the standard sand.

Table 2 - Coarseness of Total Grit Sizes

Screen Grit Size	Sieve Through Which 100% Shall Pass		Sieve Through Which At Least 99.5% Shall Pass	
	No.	*Opening	No.	*Opening
220	13 XX	100	15 XX	92
180	11 X	133	13 XX	100
150	9 Std.	169	11 X	133
120	6 Std.	241	9 Std.	169
100	3 Std.	336	6 Std.	241
80	1 Std.	421	3 Std.	336
60	38 GG	551	1 Std.	421
50	32 GG	641	38 GG	551
40	28 GG	780	32 GG	641
36	24 GG	905	28 GG	780
30	20 XXXGG	1169	24 GG	905
24	No. 14	1423	20 XXXGG	1169
20	No. 10	2018	No. 14	1423
16	No. 8	2403	No. 10	2018
12	No. 6	3385	No. 8	2403
Extra Fine, Flint	5 Std.	285	10 X	149
Fine, Emery	5 Std.	285	8 X	203
Flint	40 GG	505	5 Std.	285
Medium, Emery	40 GG	505	5 Std.	505
Flint	28 GG	780	40 GG	505
Coarse, Emery	28 GG	780	40 GG	505
Flint	24 GG	905	28 GG	780
Extra Coarse, Emery	20 XXXGG	1169	24 GG	905
Flint	20 XXXGG	1169	24 GG	905
*Openings in micrometers. From Table 4.				

(1) For emery and flint abrasive grain, the overgrade percentage of the test sample shall not exceed twice the overgrade percentage of the standard sand. For zirconia-alumina refer to table 6.

4.1.3 Fines

For aluminum oxide, garnet, and silicon carbide, the percentage of the test sample weight of abrasive grain passing through the fines sieve shall not differ by more than plus 10 percentage points or minus 7 percentage points from that shown by the standard sand. For emery and flint, the percentage of abrasive grain passing through the fines sieve shall not differ by more than plus 15 percentage points or minus 10

percentage points from that shown by the standard sand. For Zirconia Alumina refer to Table 6.[1]

4.2 Sedimentation Grit Sizes (Microgrits)

The abrasive grain shall be recovered from the coated product as described in 5.2 and tested in accordance with the testing procedure described in 6.2. The recovered abrasive grain shall be of such size distribution that its accumulation curve shall not show a particle size in excess of that shown in figure 1 by the maximum standard curve nor less than that shown by the minimum curve between 3 and 50 height percent points.

5 Abrasive Grain Recovery Procedures

5.1 Screen Grit Sizes

The procedures described herein shall be followed in recovering screen grit sizes of abrasive grain from coated abrasive products. These procedures and the conditioning procedures in 6.1.3.4 insure a free-flowing mineral. This is essential for accurate grading. Any product name used in this section is used solely for the purpose of description. Any product equivalent in performance is also acceptable.

Any burnoff method that reduces the abrasive to individual particles that can be accurately graded is acceptable. The procedures described herein are typical of procedures that can be followed to ensure accurate grading.

5.1.1 Recovery Procedure for Glue Bond Coated Abrasives

Take a sufficiently large sample of the abrasive product to insure recovery of at least 10 grams of abrasive grain for sieving. See the method described in 6.1.3.2. for handling recovered grain. Place the sample in a beaker and cover with hot water. When the glue is entirely softened and most of the abrasive grain has fallen off, wash the sample with a jet of hot water (at least 50° C) and rub or brush it gently to make certain that all of the grain is removed. Follow either Procedure A or B, depending on the grit size and type of abrasive grain of the coated abrasive product.

Procedure A:

For: Grit sizes 220 through 80 - aluminum oxide, garnet, silicon carbide and zirconia alumina
Grit sizes Fine and Medium - emery
Grit sizes 220, 180, 150 - flint
Grit sizes Extra Fine through Medium - flint

Decant through a Buchner funnel equipped with a No. 4 Whatman filter paper,[2] or its equivalent, of sufficient diameter to extend at least 6 millimeters up the sides of the funnel. If the filter clogs from the clay or other filling material present in the backing of clothbacked products, wash the abrasive grain on the filter back into the beaker and use a new filter paper for the remaining decantations, repeating this procedure if necessary. Wash the abrasive grain with hot water (at least

[1]See Table 7 for an example.
[2]Whatman filter paper or information on this product is available from the U. S. distributor, which is Reeve-Angel, Nine Bridewell Place, Clifton, New Jersey 07014.

50° C) at least four times by decantation through the filter.

In the case of products other than emery, wash the abrasive grain on the filter paper back into the beaker with hot water (at least 50° C) and add an equal amount of chemically pure concentrated (12 Normal) hydrochloric acid. Heat to boiling and boil for 7 to 10 minutes, agitating the abrasive grain once or twice during this time. Dilute and decant through a No. 4 Whatman filter, or its equivalent, in a Buchner funnel. Wash the abrasive grain with hot water (at least 50° C) three times by decantation through the filter, and then transfer all of the abrasive grain to another filter with hot water (at least 50° C). Wash once with at least 50 milliliters of alcohol. Dry the abrasive grain and filter paper in an oven at 100 ± 5° C. Brush the abrasive grain lightly from the filter paper into a crucible (either nickel or porcelain), leaving the bulk of any clay or other filling material from the backing of cloth-backed products on the filter paper. With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 ± 20° C. If such equipment is not available, the ignition may be done over a Bunsen or Meker burner. In the case of emery, do not use acid but continue washing by decantation through the filter until the abrasive grain is completely free from adhesive. Transfer all of the abrasive grain to another filter and proceed directly to the alcohol wash, drying and igniting the abrasive grain as outlined for products other than emery.

Procedure B:

For: Grit sizes 60 and Coarser - Aluminum Oxide, Garnet, Silicon Carbide and Zirconia-Alumina.
Grit sizes Coarse and Extra Coarse - emery.
Grit sizes Coarse and Extra Coarse - flint.

Filter through a U. S. Standard Sieve No. 325, [3] and wash the abrasive grain 12 times or more with hot water (at least 50° C). Transfer the grain from the sieve to a No. 4 Whatman filter paper, or its equivalent, with hot water. Wash once with at least 50 milliliters of alcohol. Dry the grain and filter paper in an oven at 110 ± 5° C. Brush the abrasive grain lightly from the filter paper into a crucible (either nickel or porcelain). With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 ± 20° C. If such equipment is not available, the ignition may be done over a Bunsen or meker burner.

5.1.2. Recovery Procedure for Glue Bond Coated Abrasives Containing a Mineral Filler

Use the procedure for glue-bond coated abrasives (see 5.1.1). However, in the case of emery grit sizes fine and medium, and all coated abrasives having mineral fillers which are insoluble in hydrochloric acid or too coarse to pass a No. 325 Sieve, separate the

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[3]This sieve is described in American Society for Testing and Materials (ASTM) E 11-70, Standard Specification for Wire Cloth Sieves for Testing Purposes.

mineral filler from the abrasive grain at some point prior to grading. This separation is made by vibratory means with sieves fine enough to retain all of the abrasive grain but coarse enough to pass all of the mineral filler as determined by microscopic examination of both the abrasive grain and the mineral filler or it is made by any other means that will insure a clean abrasive grain with no loss of the abrasive grain.

5.1.3. Recovery procedure for resin-over-glue-bond coated abrasives containing no mineral filler in the adhesive coats

Take a sufficiently large sample to insure recovery of at least 10 grams of abrasive grain for sieving. See the method described in 6.1.3.2 for Handling Recovered Grain. Place the sample in a beaker and cover with hot water (at least 50° C). When the adhesive in the making coat has been sufficiently softened, strip the abrasive grain coating from the backing by hand. Rub the backing gently with the finger tips to remove all traces of the abrasive grain. Break the large flakes of coating into relatively small clusters with a stirring rod. Follow either Procedure A or B, depending on the grit size and the type of abrasive grain.

Procedure A:

For: Grit sizes 220 through 80 - aluminum oxide, garnet, silicon carbide and zirconia-alumina
Grit sizes Fine and Medium - emery
Grit sizes 220, 180, 150 - flint
Grit sizes Extra Fine through medium - flint

Decant through a buchner funnel equipped with a No. 4 Whatman filter paper, or its equivalent, of sufficient diameter to extend at least 6 millimetres up the sides of the funnel. If the filter clogs from the clay or other filling material present in the backing of cloth-backed products, wash any abrasive grain and flakes of coating into the beaker and use a new filter paper for the remaining decantations, repeating this procedure if necessary. Wash the abrasive grain with hot water (at least 50° C) at least four times by decantation through the filter.

Transfer all solids to another filter and wash once with at least 50 milliliters of alcohol. Dry the solids and filter paper in an oven at 110 ± 5° C. Brush the abrasive grain lightly from the filter paper into a large crucible (either nickel or porcelain), leaving in the filter paper the bulk of any clay or other filling material from the backing of cloth-backed products. With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 ± 20° C. If such equipment is not available, the ignition may be done over a Bunsen or Meker burner. At this point the abrasive grain should be fairly free flowing. If this is not the case, it should be further ignited.

Brush the abrasive grain from the crucible into a beaker, add 50 to 100 milliliters of 50 percent sodium hydroxide solution and boil for at least 10 minutes. Dilute with an equal volume of water and decant through a No. 4 Whatman filter paper, or its equivalent, in a Buchner funnel. Wash

the grain with hot water (at least 50° C) at least four times by decantation through the filter.

In the case of products other than emery, follow the procedure for the case of products other than emery under Procedure A of 5.1.1.

In the case of emery, after the sodium hydroxide treatment continue washing by decantation through the filter until the abrasive grain is completely free from sodium hydroxide. Transfer all of the abrasive grain to another filter and proceed directly to the alcohol wash, drying and igniting the grain as outlined for products other than emery.

Procedure B:

For: Grit sizes 60 and Coarser - Aluminum Oxide, Garnet, Silicon Carbide and Zirconia-Alumina
Grit sizes Coarse and Extra Coarse - Emery
Grit sizes Coarse and Extra Coarse - Flint

Decant through a No. 325 Sieve, and wash the abrasive grain 12 times or more with hot water (at least 50° C) by decantation through the sieve. Transfer the abrasive grain and flakes of coating remaining on the sieve back into the beaker. Carefully decant this water through the sieve so that no solids are transferred to the sieve and dry the solids in the beaker.

Brush all of the solids into a large crucible (either nickel or porcelain). With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 ± 20° C. If such equipment is not available, the ignition may be done over a Bunsen or Meker burner. At this point the abrasive grain should be fairly free flowing. If this is not the case, it should be further ignited.

Brush the abrasive grain into a beaker, add 50 to 100 milliliters of 50 percent sodium hydroxide solution and boil for at least 10 minutes. Dilute with an equal volume of water and filter through a No. 325 Sieve. Wash the abrasive grain with hot water (at least 50° C) at least four times. Transfer the abrasive grain from the sieve to a No. 4 Whatman filter paper, or its equivalent, with hot water. Wash once with at least 50 milliliters of alcohol. Dry the abrasive grain and filter paper in an oven at 110 ± 5° C. Brush the abrasive grain lightly from the filter paper into a crucible (either nickel or porcelain). With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 ± 20° C. If such equipment is not available, the ignition may be done over a Bunsen or Meker burner.

5.1.4. Recovery Procedure for resin-over-glue-bond abrasives containing a mineral filler in either or both adhesive coats

Use the procedure for resin over glue-bond coated abrasives containing no mineral filler in adhesive coats (see 5.1.3). However, for emery grit sizes fine and medium, and all coated abrasives having mineral fillers which

are insoluble in hydrochloric acid or too coarse to pass a No. 325 Sieve, follow the separation procedure in 5.1.2.

5.1.5. Recovery procedure for resin-over-resin-bond coated abrasives containing no mineral filler in the adhesive coats

Take a sufficiently large sample to insure recovery of at least 10 grams of abrasive grain for sieving. See the method described in 6.1.3.2. for Handling the Recovered Grain. Cut the sample over a sheet of glazed paper into approximately 25 millimetre squares. Place the squares and any loose abrasive grain collected on the glazed paper into a large crucible (either nickel or porcelain). With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 ± 20° C. If such equipment is not available, the ignition may be done over a Bunsen or Meker burner. At this point the grain should be fairly free flowing. If this is not the case, it should be further ignited.

Brush the abrasive grain from the crucible into a beaker; add 50 to 100 milliliters of 50 percent sodium hydroxide solution and boil for at least 10 minutes. Dilute with an equal volume of water. Follow either Procedure A or B depending on the grit size and type of abrasive grain of the coated abrasive product.

Procedure A:

For: Grit sizes 200 through 80 - Aluminum Oxide, Garnet, Silicon Carbide and Zirconia-Alumina
Grit sizes Fine and Medium - Emery
Grit sizes 220, 180, 150 - Flint
Grit sizes Extra Fine through Medium - Flint

Decant through a No. 4 Whatman filter paper, or its equivalent, in a Buchner funnel. Wash the abrasive grain with hot water (at least 50° C) at least four times by decantation through the filter.

In the case of products other than emery follow the procedures for the case of products other than emery under Procedure A of 5.1.1.

In the case of emery (after the sodium hydroxide treatment) follow the procedure in the final paragraph under Procedure A of 5.1.3.

Procedure B:

For: Grit sizes 60 and Coarser - Aluminum Oxide, Garnet, Silicon Carbide and Zirconia Alumina
Grit sizes Coarse and Extra Coarse - Emery
Grit sizes Coarse and Extra coarse - Flint

Use Procedure B in 5.1.1 except that the abrasive grain shall be washed with hot water at least four times through the sieve.

5.1.6. Recovery procedure for resin-over-resin-bond coated abrasives containing a mineral filler in either or both adhesive coats

Use the procedure for resin-over-resin-bond coated abrasives containing no mineral filler in adhesive coats (see 5.1.5). However, for emery grits fine and medium and all coated abrasives having mineral fillers which are insoluble in hydrochloric acid or too coarse to pass a No. 325 Sieve, use the separation procedure in 5.1.2.

5.1.7. Recovery procedure for paper backed waterproof coated abrasives containing no mineral filler in adhesive coats and having adhesive coats which are soluble in denatured alcohol and caustic-water-alcohol[4]

Take a sufficiently large sample to insure recovery of at least 10 grams of abrasive grain for sieving. Cut the sample into 35 to 40 millimetre strips. Fold the strips, preferably in a zigzag manner, and place them on edge in a 600 milliliter beaker. Barely cover the strips, washing off any adhering grain with denatured alcohol. Bring solution to a boil and hold for 5 minutes. Decant through a Buchner funnel equipped with a No. 4 Whatman filter paper, or its equivalent, of sufficient diameter to extend at least 6 millimeters up the side of the funnel. Rinse thoroughly with hot water (at least 50° C) and then with denatured alcohol.

Remove the filter paper, wash the abrasive grain into a 600 milliliter beaker with approximately 100 milliliters of hot water (at least 50° C) and then discard the filter paper. Add an equal volume of chemically pure concentrated (12 Normal) hydrochloric acid to the beaker containing the abrasive grain and water, and boil approximately 10 minutes, stirring occasionally. Dilute with about 50 milliliters of hot water and filter through a No. 4 Whatman filter paper, or its equivalent. Rinse thoroughly, first with hot water and then with denatured alcohol.

Dry the filter paper and the sample in a drying oven at 100 ± 5° C, and transfer sample to an evaporating dish, or crucible, and discard filter paper. With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 ± 20° C. If such equipment is not available, the ignition may be done over a Bunsen or Meker burner.

5.1.8. Recovery procedure for paper backed and other waterproof coated abrasives containing no mineral filler in adhesive coats and having adhesive coats (such as Phenol-Aldehyde Resins) which are insoluble in readily available solvents

Use the procedure for resin-over-resin-bond coated abrasives containing a mineral filler in either or both adhesive coats (see 5.1.6).

5.1.9. Recovery procedure for paper backed and other waterproof coated abrasives containing a mineral filler in either or both adhesive coats and having adhesive coats (such as Phenol-aldehyde resins) which are insoluble in readily available solvents

Use the procedure for resin-over-resin-bond coated abrasives containing no mineral filler in adhesive coats (see 5.1.6).

[4] Caustic-water-alcohol solution consists of equal parts by volume of a 10 percent NaOH solution and alcohol.

5.2. Sedimentation Grit Sizes (Microgrits)

The abrasive grain recovery procedures described herein for sedimentation grit sizes insure abrasive grain particles which will be wet uniformly by the sedimentation medium without forming air bubbles. Thorough wetting of each particle is necessary to obtain accurate results. These procedures shall be followed in recovering abrasive grain from sedimentation grit sizes of coated abrasive products for grading.

5.2.1. Recovery Procedure for Glue Bond Coated Abrasives

Take a 230 by 280 millimetre sheet or a sufficiently large sample of abrasive product to insure at least 2 to 2.5 grams of abrasive grain for testing. Cut the sample into approximately 25 millimetre strips. Fold each strip individually in a zigzag manner and place the strips on edge in a 600 milliliter beaker. Add sufficient hot distilled water (at least 50° C) to cover the strips and heat until the abrasive grain is removed, but do not boil. Wash the pieces of backing with a jet of hot distilled water (at least 50° C) from a wash bottle, brushing or rubbing each strip gently to make certain that all of the abrasive grain is removed.

After the abrasive grain has been removed from the coated sheet, decant the liquid in the beaker through an 11 centimeter No. 42 Whatman filter paper, or its equivalent, placed in a Bunsen funnel with a platinum filter cone, using suction, or decant through a No. 42 Whatman filter paper of sufficient diameter to provide a 13 millimetre collar when placed in a Buchner funnel, using suction.

Add approximately 20 to 40 milliliters of a solution of equal parts by volume of chemically pure concentrated (12 Normal) hydrochloric acid and distilled water to the beaker containing the abrasive grain. Bring to a boil and boil for 5 to 7 minutes. Dilute with an equal volume of hot distilled water (at least 50° C), decant through the filter paper, and transfer the abrasive grain to another filter paper using hot distilled water (at least 50° C). Wash the abrasive grain and filter paper thoroughly with hot distilled water (at least 50° C) and then with alcohol.

Remove the filter paper and abrasive grain to a crucible (either nickel or porcelain). With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 $\pm$ 20° C. If such equipment is not available, the ignition may be done over a Bunsen or Meker burner.

5.2.2. Recovery procedure for waterproof coated abrasives made with adhesives which are soluble in alcohol, and caustic-water-alcohol

Take a sufficiently large sample of abrasive product to insure recovery of at least 2 to 2.5 grams of abrasive grain. Cut the equivalent of one 230 by 280 millimetre sheet into approximately 25 millimetre strips. Fold individually in a zigzag manner and place on edge in a 600 milliliter beaker. Just cover strips with equal volumes of alcohol and

caustic-water-alcohol solution. Boil until the grain drops off and remove strips, washing off any adhering grain with alcohol. Bring solution to boil and boil for 10 minutes, then filter by means of suction using an 11 centimeter No. 42 Whatman filter paper, or its equivalent, in a Bunsen funnel with a platinum filter cone. It is optional to use a Buchner funnel and larger filter paper which provides a 13 millimetre collar on the funnel sides. Rinse thoroughly with hot distilled water (at last 50° C) (10 times, approximately 25 milliliters each), and with alcohol (five times, approximately 25 milliliters each).

Remove the filter paper and wash the abrasive grain into a 600 milliliter beaker with approximately 100 milliliters of hot distilled water (at least 50° C). Dry and burn the filter paper and add any remaining abrasive grain or residue to the beaker. Add an equal volume of chemically pure concentrated (12 Normal) hydrochloric acid to the beaker containing the water and abrasive grain and boil approximately 10 minutes, stirring occasionally. Dilute with about 50 milliliters of hot distilled water (at least 50° C), and filter through a No. 42 Whatman filter paper, or its equivalent. Rinse thoroughly with hot distilled water (at least 50° C) (10 times, 25 milliliters each) with alcohol (five times, 25 milliliters each).

Dry the filter paper and sample in a drying oven at 110 ± 5° C and then break up all lumps with a spatula. Place the filter paper and the abrasive grain in a crucible (either nickel or porcelain). With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 ± 20° C. If such equipment is not available, the ignition may be done over a Bunsen or Meker burner. Stir sample at least twice before removing. Break up any lumps or clusters by working over lightly but thoroughly with a spatula.

5.2.3. Recovery Procedure for Resin-over-glue-bond, Resin-over-resin-bond, and Waterproof Coated Abrasives Made With One or More Adhesive Coats Which are Insoluble in Readily Available Solvents

Take a sufficiently large sample of abrasive product to insure recovery of at least 2 to 2.5 grams of abrasive grain. Cut the equivalent of one 230 by 280 millimetre sheet over a sheet of glazed paper into approximately 25 millimetre squares. Place the squares and any loose abrasive grain collected on the glazed paper into a large crucible (either nickel or porcelain) or evaporating dish. With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 ± 20° C. If such equipment is not available, the ignition may be done over a Bunsen or Meker burner. At this point the abrasive grain should be fairly free flowing; if this is not the case, it should be further ignited.

Brush the abrasive grain into a beaker, add 50 to 100 milliliters of 50 percent sodium hydroxide solution and boil for at least 10 minutes. Dilute with an equal volume of distilled water. Decant through a No. 42 Whatman filter paper,

or its equivalent, in a buchner funnel using a size of filter paper which provides a 13 millimetre collar on the funnel sides. Wash the abrasive grain thoroughly with hot distilled water (at least 50° C) by decantation through the filter.

Transfer any abrasive grain on the filter back into the beaker with a jet of hot distilled water (at least 50° C) and add an equal volume of chemically pure concentrated (12 Normal) hydrochloric acid. Heat to boiling and boil for 7 to 10 minutes agitating the abrasive grain once or twice during this time. Dilute and decant through a No. 42 Whatman filter paper, or its equivalent, in Buchner funnel. Wash the abrasive grain three times by decantation through the filter. Then transfer all of the abrasive grain to another filter paper with hot distilled water (at least 50° C.) Wash once with alcohol. Dry the abrasive grain and filter paper in an oven at 110 ± 5° C. Place the abrasive grain and the filter paper into a crucible (either nickel or porcelain). With occasional stirring, ignite the abrasive grain until all combustible material is burned to an ash. Preferably, this should be done in a muffle furnace at 600 ± 20° C. If such equipment is not available, the ignition may be done over a Bunsen or Meker burner.

6 Testing Procedure

6.1 Screen Grit Sizes - CAMI Sifter See Section 7 for Rotap Sifter

6.1.1. Standards Sands

The standard sands used for the determination of conformity to the grading limits of screen grit sizes for the various types of abrasive grain are listed in table 3.

6.1.2 Test Sieves

The nominal aperture opening and mesh of the test sieves used for the determination of the screen grit sizes of abrasive grain are given in table 4. These test sieves have an inside diameter of approximately 100 millimetres and shall have not less than 7740 sq. millimetres of screening area.[5] The silk bolting or equivalent cloth shall be carefully selected for mesh count and uniformity of openings, and shall be mounted taut in the frame without unduly disturbing either the size or the shape of the openings.

6.1.3 Method of Test

6.1.3.1. Selection of Test Sieves

The test sieves to be used for determining the grading of screen grit sizes are shown in table 5. Before they may be considered as being satisfactory for use, they shall be tested by use of "standard sands" in the manner described as follows:

If a sieve is used as the test sieve for any type and grit size of abrasive grain, it must qualify as a control sieve using the "standard sand" for that type and grit size of abrasive grain. It shall be considered as being satisfactory for use as a test sieve only if, and as long as, it yields an overgrade percentage by weight within the limits shown in table 5.

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[5]Special frames for these sieves are available from the Washington Mills Electro-Minerals Company, Niagara Falls, New York 14302.

Table 3 - Standard Sands for Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet, Flint, and Emery

Screen Grit Size	Type of Abrasive Grain	Standard Sand	
		Mineral	Date
220	Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet, Flint	Garnet[a]	3/12/52
180	Aluminum Oxide, Silicon Carbide, Zirconia Alumina , Garnet, Flint	Garnet[a]	7/01/52
150	Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet, Flint	Garnet[a]	12/23/53
120	Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet	Garnet[a]	4/21/55
100	Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet	Garnet[a]	4/20/50
80	Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet	Garnet[a]	4/20/50
60	Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet	Garnet[a]	1/18/55
50	Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet	Garnet[a]	6/04/53
40	Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet	Garnet[a]	1/10/51
36	Aluminum Oxide, Silicon Carbide, Zirconia Alumina , Garnet	Garnet[a]	6/00/43
30	Aluminum Oxide, Silicon Carbide, Zirconia Alumina , Garnet	Garnet[a]	10/25/49
24	Aluminum Oxide, Silicon Carbide, Zirconia Alumina , Garnet	Garnet[a]	6/24/54
20	Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet	Garnet[a]	11/00/41
16	Aluminum Oxide, Silicon Carbide, Zirconia Alumina	Al.Ox.[a]	6/11/52
12	Aluminum Oxide, Silicon Carbide, Zirconia Alumina	Al.Ox.[a]	11/10/47
Fine	Emery	Emery[a]	1/05/55
Medium	Emery	Emery[a]	1/05/55
Coarse	Emery	Emery[a]	1/05/55
Extra Coarse	Emery	Emery[a]	1/05/55
Extra Fine	Flint	Quartz[b]	4/01/52
Fine	Flint	Quartz[b]	4/01/52
Medium	Flint	Quartz[b]	4/01/52
Coarse	Flint	Quartz[b]	4/01/52
Extra Coarse	Flint	Quartz[b]	4/01/52

[a]These standard sands designated for Aluminum Oxide, Silicon Carbide, Zirconia Alumina, Garnet, Flint and Emery may be purchased from the Washington Mills Electro-Minerals Company, Niagara Falls, New York 14302. The dates are included for the purpose of identification, and represent the standard sands that are currently in use by the industry.

[b]The standard sands for Extra Fine through Extra Coarse flint may be obtained from the Minnesota Mining and Manufacturing Company, 3M Center, St. Paul, Minnesota 55101.

Table 4 - Nominal Aperture Openings and Mesh of Coated Abrasives Manufacturers' Institute Test Sieves for Controlling Screen Grit Sizes of Abrasive Grain

Screen Size	Sieve Cloth Designation Silk Bolting Cloth[a]/or Equivalent	Aperture Opening		Mesh (Warp and Weft) Openings per Inch (25.4 mm)
		Inch	Micrometers	
200	25 Std. Dufour	0.0025[a]	64[a]	196[b]
180	21 Std. Dufour	.0027	69	178
157	16X Dufour	.0032	82	157
150	15XX Dufour	.0036	92	150
129	13XX Dufour	.0039	100	129
116	11X Dufour	.0052	133	116
109	10X Dufour	.0058	149	109
97	9 Std. Dufour	.0066	169	97.5
86	8X Dufour	.0079	203	85.5
74	6 Std. Bodmer	.0094	241	74
66	5 Std. Dufour	.0111	285	66
58	3 Std. Dufour	.0131	336	58.5
48	1 Std. Dufour	.0164	421	48.5
40	40GG Dufour	.0197	505	39
38	38GG Dufour	.0215	551	37
32	32GG Bodmer	.0250	641	32
28	28GG Dufour	.0304	780	27.5
24	24GG Bodmer	.0353	905	24
20	20XXXGG Dufour	.0456	1169	19.5
18	18GG Dufour	.0519	1331	17.5
	Wire Cloth[c]			
14	No. 14	0.0555	1423	-
12	No. 12	.0661	1695	-
10	No. 10	.0787	2018	-
8	No. 8	.0937	2403	-
6	No. 6	.1320	3385	-

[a]The nominal aperture opening for each silk bolting cloth represents the mode or aperture of most frequent occurrence in 100 openings measured between warp threads. Measurements made by other methods will give noticeably different results. This should be kept in mind in making comparisons between the figures shown and other figures.

[b]The values for the mesh are the standard counts of the manufacturers of the silk bolting cloth or equivalent, adjusted to the nearest full or 1/2 mesh. Mesh count in the warp direction is subject to minor variations and is as a rule within ± 1% of the standard count. Mesh count in the weft direction is subject to somewhat greater variations.

[c]The wire cloth for placing in CAMI sieve frames may be obtained from the Newark Wire Cloth Co., 351 Verona Ave., Newark, New Jersey 07104 or from the W. S. Tyler Co., 3615 Superior Ave., Cleveland, Ohio 44114. The Wire cloths comply with the American Society for Testing and Materials' Standard Designation E11, Specifications for Sieves and Testing Purposes. Copies may be obtained from the ASTM's office, 1916 Race Street, Philadelphia, Pennsylvania 19103.

Table 5 - Limits Within Which the Control and Fines Sieves Must Separate the Standard Sands for Abrasive Grain, and Sieves Used for Testing the Coarseness of Total Grit Size* For Cami Sifter[a]

Screen Grit Size	Type of Abrasive Grain	Coarseness of Sieve for 100% Passage	Total Size Sieve for 99.5% Passage	Control Sieve	Overgrade Percentage[b] Min.	Overgrade Percentage[b] Max.	Fines Sieve	Fines Percentage[b] Min.	Fines Percentage[b] Max.
220	Aluminum oxide, silicon carbide, zirconia-alumina, garnet, flint	13XX	15XX	21 Std.	5.1	9.1	25 Std.	45.4	65.4
180	Aluminum oxide, silicon carbide, zirconia-alumina, garnet, flint	11X	13XX	15XX	9.5	15.5	21 Std.		
150	Aluminum oxide, silicon carbide, zirconia-alumina, garnet, flint	9 Std.	11X	13XX	6.7	12.7	15XX		
120	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	6 Std.	9 Std.	11X	10.9	16.9	13XX		
100	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	3 Std.	6 Std.	9 Std.	6.3	12.3	11X		
80	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	1 Std.	3 Std.	6 Std.	8.4	14.4	9 Std.		
60	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	38GG	1 Std.	3 Std.	4.4	8.4	6 Std.		
50	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	32GG	38GG	1 Std.	3.0	6.4	3 Std.		
40	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	28GG	32GG	38GG	3.0	6.0	1 Std.		
36	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	24GG	28GG	32GG	9.7	15.7	38GG		
30	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	20XXXGG	24GG	28GG	14.6	20.6	32GG		
24	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	No. 14	20XXXGG	24GG	8.6	14.6	28GG		
20	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	No. 10	No. 14	20XXXGG	3.7	7.7	24GG		
16	Aluminum oxide, silicon carbide, zirconia-alumina,	No. 8	No. 10	No. 14	10.5	16.5	18GG	20.4	30.4
12	Aluminum oxide, silicon carbide, zirconia-alumina,	No. 6	No. 8	No. 10	7.0	13.0	No. 12	34.0	54.0
Fine	Emery	5 Std.	8X	13XX	7.3	15.3	21 Std.		
Medium	Emery	40GG	5 Std.	8X	4.6	10.6	13XX		
Coarse	Emery	28GG	40GG	5 Std.	4.3	12.3	9 Std.		
Extra Coarse	Emery	20XXXGG	24GG	1 Std.	7.5	15.5	5 Std.		
Extra Fine	Flint	5 Std.	10X	16X	12.5	20.5	25 Std.	20.0	50.0
Fine	Flint	40GG	5 Std.	10X	6.0	14.0	16X		
Medium	Flint	28GG	40GG	5 Std.	6.0	14.0	10X		
Coarse	Flint	24GG	28GG	40GG	4.1	12.1	5 Std.		
Extra Coarse	Flint	20XXXGG	24GG	28GG	3.6	9.6	40GG		

[a] For detailed information on sieves, see Table 4.
[b] If a sieve does not separate the standard sand within these limits, it must be discarded (see 6.1.3.1).

Table 5A - Limits Within Which the Control and Fines Sieves Must Separate the Standard Sands for Abrasive Grain, and Sieves Used for Testing the Coarseness of Total Grit Size* For Rotap Sieves

Screen Grit Size	Type of Abrasive Grain	Coarseness of Sieve for 100% Passage	Total Size Sieve for 99.5% Passage	Control Sieve	Overgrade Percentage		Fines Sieve	Fines Percentage	
					Min.	Max.		Min.	Max.
220	Aluminum oxide, silicon carbide, zirconia-alumina, garnet, flint	13XX	15XX	21 Std.	5.1	13.1	25 Std.	45.4	65.4
180	Aluminum oxide, silicon carbide, zirconia-alumina, garnet, flint	11X	13XX	15XX	8.5	16.5	21 Std.		
150	Aluminum oxide, silicon carbide, zirconia-alumina, garnet, flint	9 Std.	11X	13XX	5.7	13.7	15XX		
120	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	6 Std.	9 Std.	11X	9.9	17.9	13XX		
100	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	3 Std.	6 Std.	9 Std.	5.3	13.3	11X		
80	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	1 Std.	3 Std.	6 Std.	7.4	15.4	9 Std.		
60	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	38GG	1 Std.	3 Std.	4.4	10.4	6 Std.		
50	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	32GG	38GG	1 Std.	3.0	8.4	3 Std.		
40	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	28GG	32GG	38GG	3.0	8.0	1 Std.		
36	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	24GG	28GG	32GG	8.7	16.7	38GG		
30	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	20XXXGG	24GG	28GG	13.6	21.6	32GG		
24	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	No. 14	20XXXGG	24GG	7.6	15.6	28GG		
20	Aluminum oxide, silicon carbide, zirconia-alumina, garnet	No. 10	No. 14	20XXXGG	3.7	9.7	24GG		
16	Aluminum oxide, silicon carbide, zirconia-alumina,	No. 8	No. 10	No. 14	9.5	17.5	18GG	20.4	30.4
12	Aluminum oxide, silicon carbide, zirconia-alumina,	No. 6	No. 8	No. 10	6.0	14.0	No. 12	34.0	54.0

NOTE: Rotap Screens must be the equuivalent in aperture and or mesh openings as described in Table 4.

If the same designation of sieve is used to test the "coarseness of total grit size" or is used as the fines sieve for either a coarser grit size of the same type of abrasive grain or any grit size for some other type of abrasive grain, it shall be considered as being satisfactory for such use if it has been tested and found to be satisfactory as a control sieve.

Certain sieves, (for example, the one using 25 Std., 18GG silk cloth, and No. 12 wire cloth) are fines sieves only. Each of these sieves shall be tested as a fines sieve using the standard sand for the grit size and type of abrasive grain for which it is a fines sieve. Each shall be considered satisfactory for use as a test sieve only if, and as long as, it yields a fines percentage by weight within the limits shown in Table 5.
Sieves using No. 8 and No. 6 wire cloth are only for testing the "coarseness of total grit size" of grit sizes 16 and 12. Therefore, they do not need to be tested with the standard sands to determine their suitability for such use, but must comply with ASTM E-11, "Specification for Sieves for Testing Purposes."

6.1.3.2 Sampling

Abrasive grain samples recovered as described in 5.1, and standard sands which are to be tested for grading, shall be reduced to proper weight by quartering, as follows (See also Riffle method):

Place the abrasive grain on a square piece of hard surfaced paper, Grasp diagonally opposite corners of the paper, raise first one corner then the other, causing the abrasive grain to roll from the center of the sheet toward one corner, then across toward the opposite corner, and then back to the center. Next, grasp the other two diagonally opposite corners and repeat the procedure. Continue mixing in this manner for at least five complete cycles in each direction and finally shape the abrasive grain into a flat circular pile in the center of the sheet.

By means of a large spatula inserted through the top of the pile of abrasive grain, carefully split the pile of abrasive grain, first into halves and then into quarters. In each operation the edge of the spatula should be held firmly against the paper so that all the abrasive grain is removed. Using a spatula, and a camel hair brush if necessary, completely remove two diagonal opposite quarters.

Repeat this entire procedure with the remaining abrasive grain, except, after mixing, remove the quarters at 90 degrees to those previously removed. Continue repeating the procedure removing alternate quarters after each mixing until the amount required for testing remains (10 grams for CAMI; 100 grams for ROTAP). Minor adjustments to the final amount may be made by use of a spatula.

6.1.3.3 Riffle Reduction Method

Select a riffle suitable for separation of coarse grains (No. 10 riffle) for 220 grit and coarser. Riffling is not recommended for fine grits (240 and finer) since dusting, piling, flow and static separation can influence accuracy.

A prepared representative sample of between 200 and 2000 grams is carefully introduced to the riffle by pouring it uniformly through the unit. Once the sample is split, select at random one of the two riffled containers and repeat the process until the required sample size is obtained (10 grams for CAMI; 100 grams for ROTAP). Note: To ensure proper riffling, make certain the inner surfaces of the riffle are smooth and rust-free; the receiving containers fit tightly to the outlet of the riffle to prevent sample spillage, and the grid or tracks are free and unplugged by particles.

6.1.3.4 Conditioning

All quartered samples and test equipment shall be conditioned in a room held at 21± 1° C and 50 ± 2 percent relative humidity. Testing can commence immediately, however, it is recommended that the sample be conditioned for two hours to ensure normalization.

6.1.3.5 Mechanical Sieving - CAMI Sifter

Testing to determine the size distribution of the abrasive grain (as recovered from the coated abrasive product in accordance with section 5) shall be performed by sieving on a sieve shaking machine. [6] A 10 gram sample of the standard sand shall be used for calibrating the test sieves for the size determinations. The control sieve is positioned directly above the fines sieve in the shaker so that when the abrasive grain being tested is placed on the control sieve, that portion of it passing the control sieve will feed directly into the fines sieve. The rate of shaking shall be approximately 275 complete strokes or cycles per minute, and the sieves shall rotate at the rate of approximately 9 rotations per minute. The test shall be continued until 2,750 strokes or cycles have been completed.

In the case of new abrasive grain or grain recovered from the coated sheet, the overgrade, control, and fines portions, is then screened in the same manner, for coarseness of total grit size using the sieves listed in table 2 to determine compliance with the limits shown.

6.1.3.6 Hand Sieving (Alternate)

Hand sieving may be used as an alternate method of test provided that the ambient conditions described in 6.1.3.4. are maintained. A 10 gram sample of abrasive grain shall be tested first through the fines sieve, then through the control sieve. That portion of the abrasive grain remaining on the control sieve shall then be tested in the same manner for coarseness of total grit size using the sieves listed in Table 2 to determine compliance with the limits shown. The sieves shall be shaken in substantially a horizontal position by striking the side of the sieve frame against the palm of the hand.

A stroke of approximately 25 millimetres shall be used and the rate of shaking shall be approximately 275 strokes or cycles per minute. The sieve frames shall not be struck with or against any hard object during sieving. Shaking shall be continued with each sieve until the amount of abrasive grain passing

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[6]Mechanical sieve shakers especially designed tomeet the requirements of this Product Standard may be purchased from the Washington Mills Electro-Minerals Company, Buffalo Avenue, Niagara Falls, N. Y. 14302.

through the sieve is equal to or less than 1 percent by weight per minute.

6.1.3.7 Presentation of Data (Example of Normal Test Result)

The data in Table 7 illustrates a normal test result for a grit size 120 coated abrasive product as obtained by recovering the abrasive grain from the coated sheet and testing it according to the procedures described herein.

6.1.3.8 Referee Test

Whenever the test results are a point of issue, duplicate tests shall be made of the abrasive grain in question and its standard sand, and in each instance the standard sand shall be tested either immediately before or after the abrasive grain in question.

6.2 Sedimentation Grit Sizes (Microgrits)

6.2.1 Theory of Grading by Sedimentation

The method of determining the particle size on grading of an abrasive grain by sedimentation is based on Stokes' Law, which as applied to small spheres falling in a viscous liquid, may be expressed in the following form:

$$V = \frac{2gr^2(p-d)}{9n} \qquad \text{(Eq 1)}$$

V - Settling velocity of the falling particle in centimeters per second.

g - Acceleration due to gravity, 980 centimeters per second per second.[7]

r - Effective particle radius in centimeters.

p - Density of the particles in grams per cubic centimeters.

d - Density of the settling medium in grams per cubic centimeters.

n - Viscosity of the settling medium in poises; i.e., in dyne seconds per square centimeters.

From Equation 1:

$$r \text{ (in cm)} = \sqrt{\frac{9nV}{2g(p-d)}} \qquad \text{(Eq 2)}$$

D - Effective particle diameter in micrometers - 1 cm = 10,000 micrometers.

Therefore:

$$D \text{ (in micrometers)} = 20{,}000\sqrt{\frac{9nV}{2g(p-d)}} \qquad \text{(Eq 3)}$$

[7] The value of g, the acceleration due to gravity, depends upon altitude and latitude. The International Committee on Weights and Measures has adopted as an acceptable value a figure of 980.665 cm per second. However, the value 980 may be used as sufficiently accurate.

Table 6 - Graded Zirconia Alumina Grain
Grading Limits ("S" Refers To Value of Standard Sand on Sieves in Accordance with ANSI B74.18)

Size	Retained on Coarse Grain Sieve	Retained on Overgrade Sieve	Through overgrade Retained on Nominal Sieve
16	0	S to S+8	S-16 to S+4
20	0	S-2 to S+6	S-10 to S+10
24	0	S-2 to S+6	S-5 to S+15
30	0	S-2 to S+6	S-10 to S+10
36	0	S+2 to S+10	S-16 to S+4
40	0	S-2 to S + 6	S-10 to S+10
50	0	S+2 to S+10	S-13 to S+7
60	0	S-2 to S+6	S-10 to S+10
80	0	S-4 to S+4	S-8 to S+12
100	0	S-2 to S+6	S-10 to S+10
120	0	S-2 to S+6	S-10 to S+10
150	0	S-2 to S+6	S- 10 to S+10
180	0	S to S+8	S-5 to S+15
220	0	S to S+8	S-5 to S+15

Table 7 - Data Presentation Example for a Grit Size 120

Sieving Results	Std. Sand	Sample	Required Limits
Percent through 6 Std.		100.0	100%
Percent through 9 Std.		99.7	99.5 Min.
Percent on 11X	13.9	12.0	16.7 Max. (1.2 times Std. Sand overgrade)
Percent on 13XX	59.4	63.0	
Percent through 13XX	26.7	25.0	19.7 Min. (Std. Sand minus 7% points)
			36.7 Max. (Std. Sand plus 10% points)

V (in centimeters per second) = $\frac{L}{60T}$

L = Length of settling tube in centimeters.

T = Time of settling in minutes.

D (in micrometers) =

$$20{,}000 \sqrt{\frac{9nL}{2g(p-d)60T}} \qquad \text{(Eq 4)}$$

The terms n, L, g, p, and d are all constant for a given settling medium, temperature, abrasive grain, locality, and equipment. Therefore:

$$20{,}000 \sqrt{\frac{9nL}{2g(p-d)60}}$$

may be considered as a constant, K, and Equation 4 may be written in the following term:

$$\text{D (in micrometers)} = K \sqrt{\frac{1}{T}} - \frac{K}{\sqrt{T}} \qquad \text{(Eq 5)}$$

In applying Equation 5, it is, of course, necessary to compute the value of K for each temperature and for each type of abrasive grain, since K is dependent not only upon L, g, and p, but also upon d and n, the density and viscosity of the settling medium, respectively, both of which are variables with respect to temperature. (See 6.2.10)

6.2.2 Standard Sedimentation Apparatus.[8]

The sedimentation apparatus to be used for the determination of the grading sedimentation grit sizes shall consist of the following elements which shall be assembled as shown in Fig. 2.

Glass water jacket, length 87 to 90 cm, diameter 6 to 9 cm diameter.

Rubber centering spacer and sedimentation rubber stopper.

Sedimentation tube, cylindrical in shape, length 94 cm, inside diameter 20 mm ± 0.5 mm.

Collecting tube of special design equal in all respects to that shown in Fig. 3. The end of the tube shall be open and cut off square with the walls. All the graduation shall be accurately etched on the tube.[9]

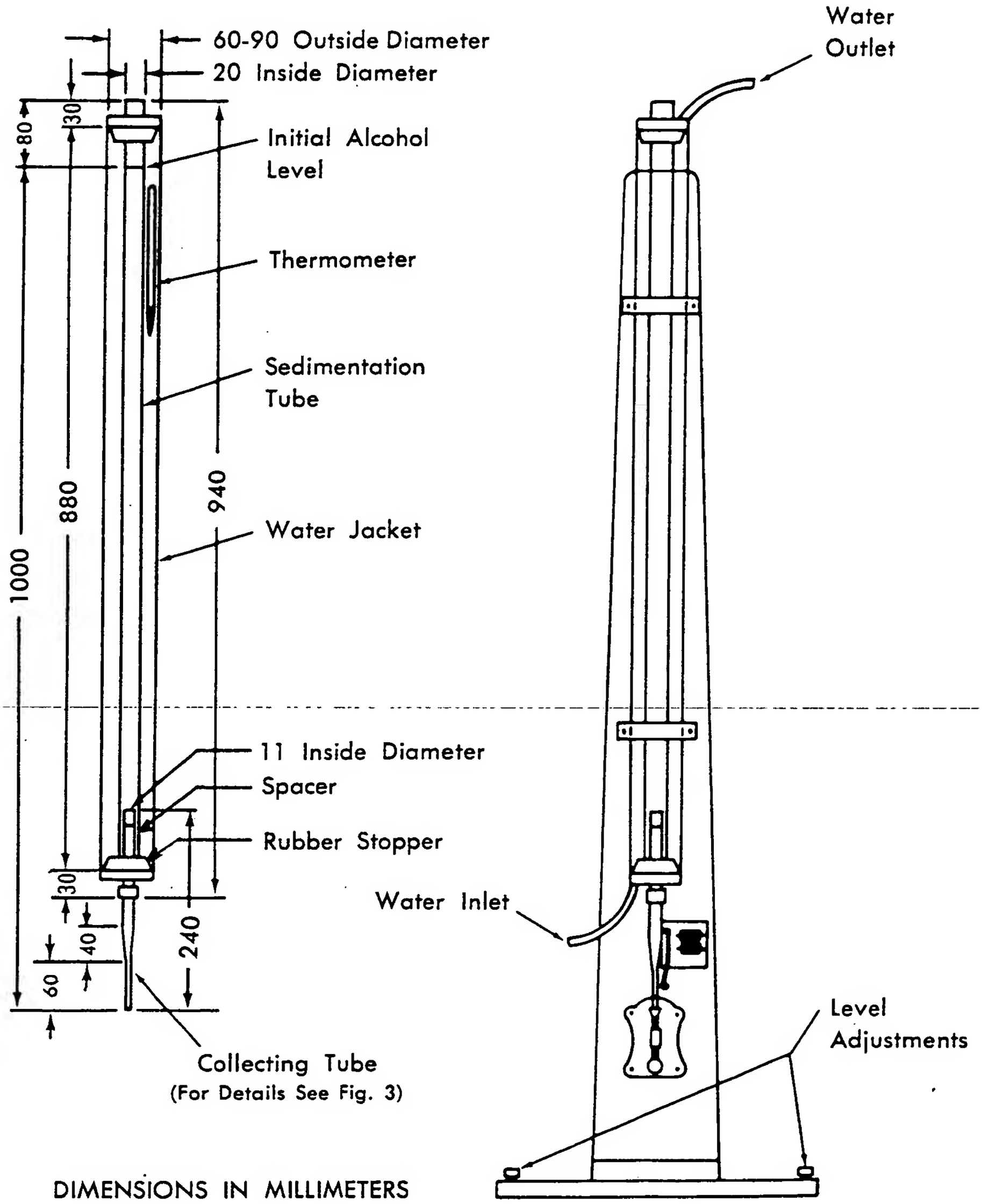
Thermometer graduated from 0° to 100° C accurate to + 0.2° C.

Stop watch or accurate electric clock capable of being read to 0.01 minute.

Frame equipped with the necessary rings and fittings to hold the glass water jacket, sedimentation tube, collecting tube, and support hardware.

[8] The Standard Sedimentation Apparatus and the Standard Sedimentation Medium is available from 3M Co., 3M Centre, St. Paul, Minnesota 55101.
[9] Suitable tubes are available from ACE Glass Co., Vineland, New Jersey (Cat. #74342).

Figure 2
Example of Assembly of Standard Sedimentation Apparatus



DIMENSIONS IN MILLIMETERS

A 25 millimetre thick metal base plate large enough and heavy enough to give stability to the apparatus, drilled for mounting the frame and equipped with adjusting screws to permit adjustment of the assembly to a vertical position.

The following accessories: test tube, wash bottle, plumb bob, rubber stopper, magnifying glass, seamless funnel, meter stick, rubber policeman, medicine dropper.

6.2.3 Checking Minerals[10]

The checking minerals consist of two carefully prepared size distributions of silicon carbide abrasive grain numbered 280 and 320.

6.2.4 Curves for Checking Minerals

A certified accumulation curve shall be supplied with each lot of checking mineral. The micrometer sizes of the certified accumulation curve shall agree to within 2 percent at the 10, 20, 30, 40, and 50 height percent points with the appropriate accumulation curve shown in Fig. 4.

6.2.5 Methods of Test

6.2.5.1 Control of Sedimentation Grit Sizes

The checking minerals are used to check the sedimentation apparatus, the sedimentation medium, and the testing technique. The grading of a sedimentation grit size shall be determined with respect to its standard curves shown in Fig. 1 only after the above checks have been carried out as outlined in 6.2.8.

6.2.6 Sedimentation Medium[11]

The sedimentation medium shall consist of a mixture of approximately 99.0 percent synthetic methanol[12] and distilled water[13] which has been carefully blended to a total water content of 4 percent plus or minus 0.1 percent by weight as determined by Karl Fischer Titration Method[14] containing a dispersant as described in 6.2.7.

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[10]A suitable set of checking minerals is available from 3M Co., 3M Center, St. Paul, Minnesota 55101. These checking minerals have been treated according to the procedure outlined for preparing sedimentation grades and need no further treatment to insure good wetting.

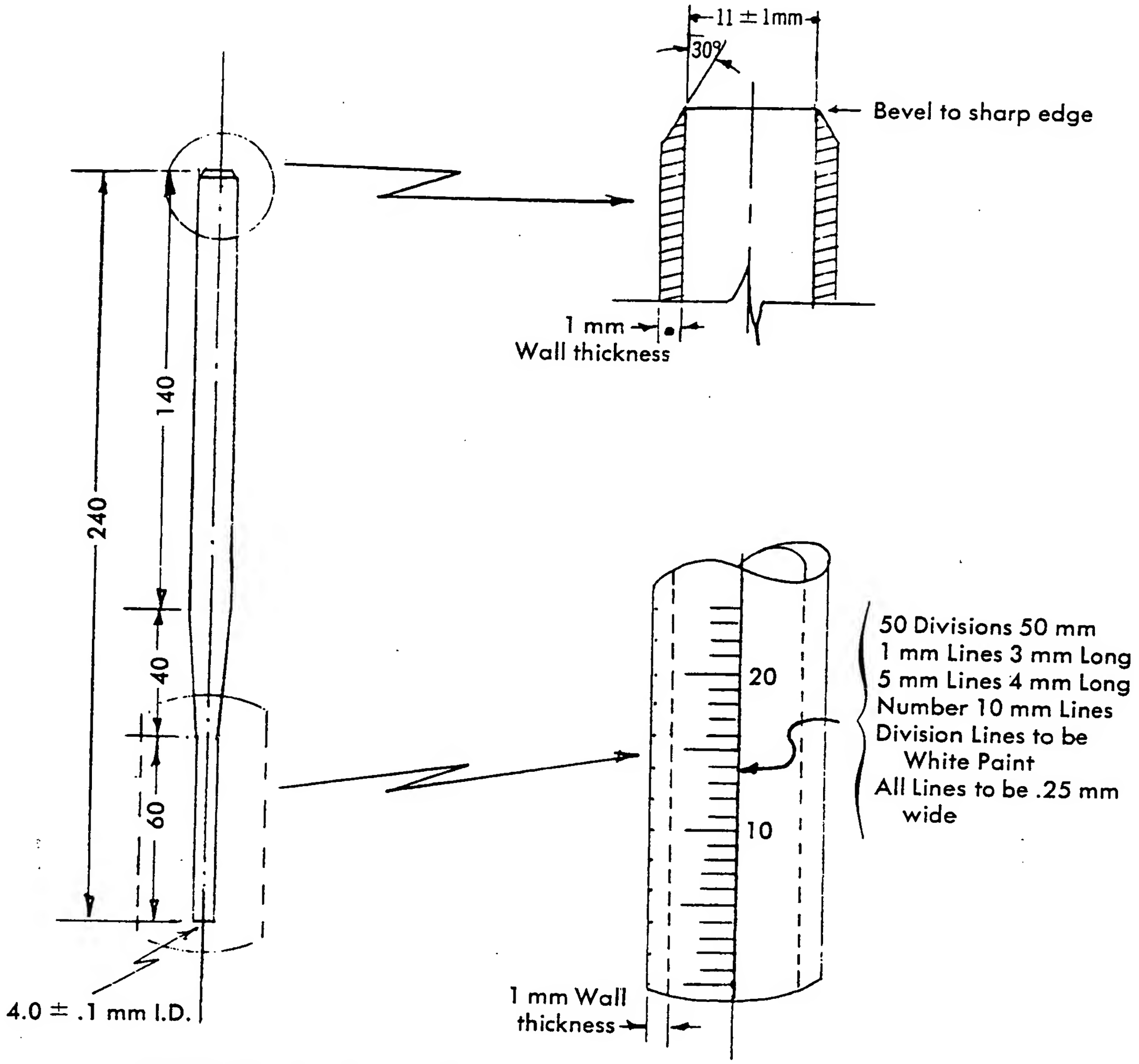
[11]Sedimentation medium available from 3M Co., 3M Center, St. Paul, Minnesota 55101.

[12]Suitable synthetic methanol has a typical analysis of:
.0002 non-volatile matter
.001 acetone content
.002 acidity (as acetic)
.003 alkalinity (as Nhs)
99.98 Methanol

[13]Suitable distilled water has a typical analysis of:
Totalhardness-0.0
Chlorides-less than 1 part per million
Free CO_2-less than 1 part per million
Iron-0.02 parts per million
Copper-0.10 parts per million
Manganese-0.07 parts per million

[14]The Karl Fischer method of waer determination by titration can be found in the book: F. J. Welcher, Standard Methods of Chemical Analysis, Sixth edition, Volume 2-A (Princeton, N. J., D. Van Nostrand Co., Inc., 1962)

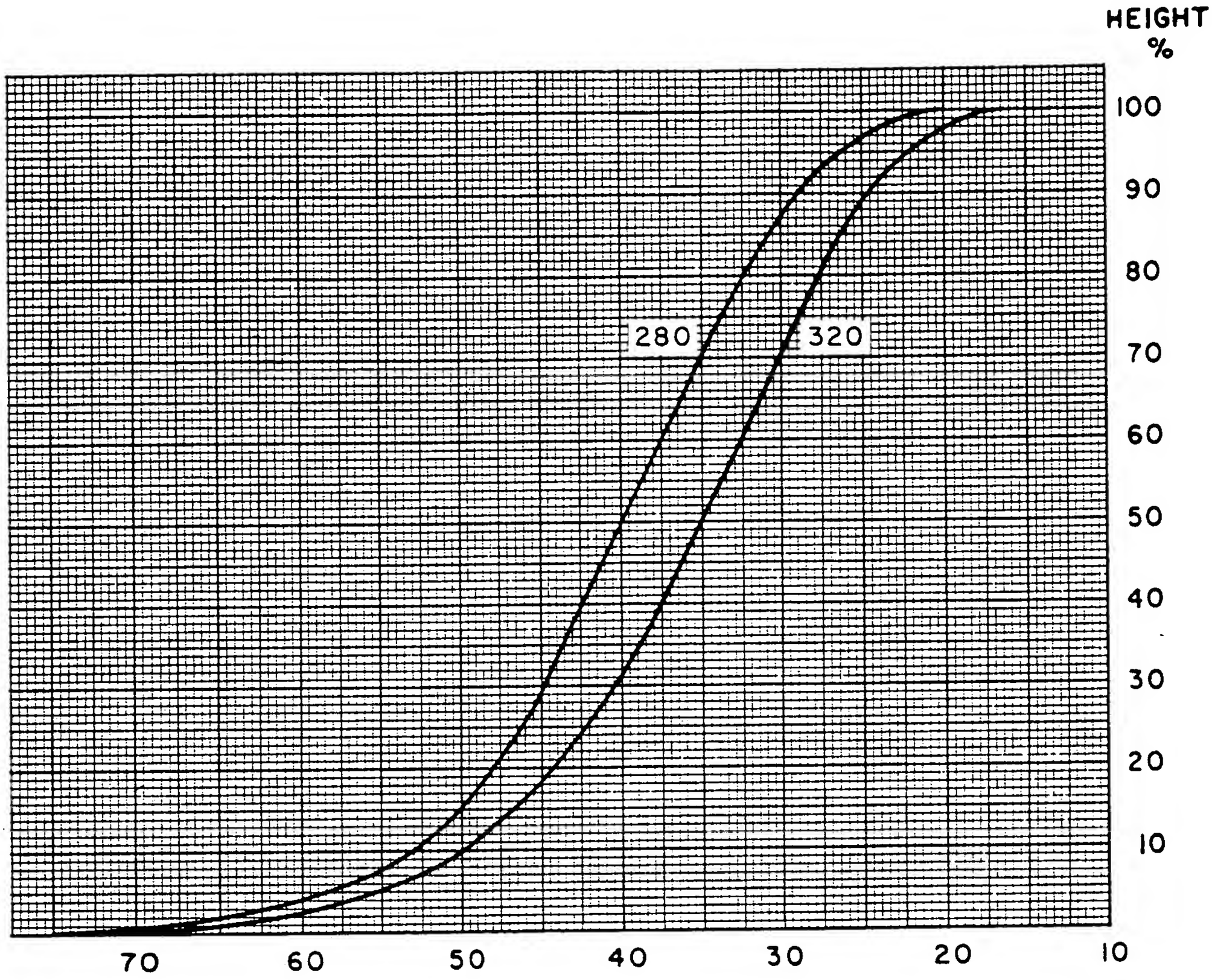
Figure 3
Collecting Tube



DIMENSIONS IN MILLIMETERS

The rubber centering and supporting spacer shall have a 19.8 millimeter outside diameter, and a 12.7 millimeter inside diameter with eight notches 22.5° wide equally spaced about the periphery approximately 2 millimeters deep. The sedimentation tube rubber stopper has approximately a 11.9 millimeter inside diameter, a 26 millimeter length, and a large diameter of 24 millimeters, and a small diameter of 18 millimeters (tapered shape).

Figure 4
Micrometer Values for Checking Minerals for Sedimentation Grit Sizes



Height Percent	Micrometer Size 280	320
0	74.7	75.1
3	62.1	58.7
10	52.9	49.8
20	47.9	44.2
30	44.7	40.5
40	42.0	37.5
50	39.7	34.9
60	37.4	32.5
70	35.0	30.1
80	32.3	27.5
90	28.8	24.4
100	20.0	16.5

6.2.7 Dispersing Agent

A dispersing agent, sodium lignosulfonate[15] highly purified, and partially desulfonated shall be added to the alcohol/water mixture in the amount of 12 milligrams per litre.

6.2.8 Calibration of Equipment

After the sedimentation apparatus has been assembled, it shall be checked for several important variables, any one of which might easily impair the accuracy of results. First, check the perpendicularity of the assembled stack by means of the plumb bob on a fine thread suspended on a cross wire from the top of the sedimentation tube in such a manner that the thread passes down through the collecting tube. If the thread does not pass through the center of both the sedimentation tube and the collecting tube, adjust the perpendicularity of the stack by means of the level adjusting screws in the base plate until this condition is satisfied.

The collecting tube shall be positioned so that it samples the center of the settling column and should be held firmly in place by a rubber spacer located about 30 mm from the top of the tube so that eddy currents will not be created in the settling medium when the rubber stopper under the collecting tube is tapped. The sedimentation tube shall be assembled so that the column of settling medium is 1000 mm $\pm$ 1 mm in length.

After the apparatus has been checked for proper assembly, as outlined above, the overall accuracy of the test shall be determined by grading one or more test tube samples of the checking minerals. Overall accuracy shall be measured by a consideration of the micrometer values at the 10, 20, 30, 40, and 50 height percent points. The values at each of these points as read from the accumulation curves obtained by testing the checking minerals should agree within $\pm$ 0.5 micrometer with those obtained from the certified curves, and the average of the algebraic sum of the deviations shall not exceed $\pm$ 0.3 micrometer. If both of these conditions are satisfied it shall be considered that all elements of the test are as they should be and that the grading of a sedimentation grit size may be determined and referred to its standard curve. If either or both of these conditions are not satisfied, it shall be considered that the equipment is not in proper adjustment, the technique of performing the test is in error, or the sedimentation medium is of improper density or viscosity or both. The equipment shall then be rechecked and adjusted, testing procedure shall be scrutinized, and further tests shall be made with new lots of sedimentation medium and the checking minerals until the cause of the incorrect results has been determined and corrected.

6.2.9 Grading Technique and Analysis

Grading analysis shall be made in several steps as follows:

6.2.9.1 Thoroughly mix the abrasive grain to be graded by either rolling or

[15]Marasperse CB available from the American Can Company, Marathon Products Division, 100 Park Avenue, New York, N. Y. 10017

quartering. Place a sufficient amount of the sample in a test tube to insure 20 to 25 millimetres of abrasive grain in the collecting tube when it is settled. Add 15 ml of the settling medium and gently work over the abrasive grain in the test tube with a standard rubber policeman until no lumps are visible in the bottom of the tube on shaking and quickly rolling the tube over into a horizontal position with the thumb held lightly over the open end of the tube. The abrasive grain and the sedimentation medium should be allowed to remain in the test tube at least a half hour and preferably one hour, and should be shaken vigorously three times during this period. During the soaking period the temperature of the sedimentation medium in the test tube should be kept the same as that of the sedimentation medium in the sedimentation tube.

6.2.9.2 Fill the sedimentation tube with sedimentation medium to a point 1000 mm from the bottom of the collecting tube and allow to stand until the temperature comes to equilibrium with the temperature of the water in the water jacket surrounding the sedimentation tube. Check the temperature of the sedimentation tube, the temperature of the water in the water jacket, and the temperature of the sedimentation medium in the test tube to insure that all are the same and are within the range of 20° to 30° C.

6.2.9.3 Place a seamless funnel on the sedimentation tube. With the thumb held lightly over the open end of the test tube containing the abrasive grain and sedimentation medium, shake the tube vigorously for at least 30 seconds. Transfer its contents rapidly to the sedimentation tube by holding the test tube inverted with the open end level with the top of the funnel so that when the sample is released it will flow down the slope of the funnel and onto the top of the settling medium.

6.2.9.4 Record the time of transfer as the time of the start of settling. Quickly remove the funnel from the top of the sedimentation tube to prevent any abrasive grain from dropping into the tube after settling has begun, because this will distort the results.

6.2.9.5 The time of the initial point shall be considered as the time when the first steady stream of abrasive grain particles arrives at the bottom of the collecting tube. Examine the falling particles to determine if the cleaning procedure has been adequate. Agglomeration and flakes of ash indicate incorrect or inadequate grain preparation. Should such a condition exist, discard the analysis.

6.2.9.6 Take subsequent readings (time) as the level of the abrasive grain rises just past the etched graduations. Consider the end point of the determination of grit size as the time when all of the abrasive grain particles have settled; that is, when the column of grain will not rise on standing.

6.2.9.7 Tap the rubber stopper at the bottom of the collecting tube gently but constantly during the time that the abrasive grain particles are falling in order to pack the particles and to keep them level, thus making accurate readings possible. For this tapping, use a carefully calibrated automatic tapper

or a pencil around one end of which has been placed a one-inch piece of rubber suction tubing. Confine the tapping to the front quarter of the rubber stopper beneath the collecting tube. No tapping should be done on the metal arm supporting the sedimentation tube, or on the collecting tube itself. Automatic tapping may be substituted for manual tapping provided that it has been demonstrated to produce identical results.

6.2.10 Presentation of Data

Table 8, Accumulated Height Percent, and Tables 9, 10, 11, and 12, Time-Diameter Tables, are used in presenting grading results determined by sedimentation. Table 8 shows the accumulated height percent represented by each millimetre of the fully-settled abrasive grain sample collected between the heights of 20 through 25 millimetres. The time-diameter tables show the effective diameter of the various particles in micrometers for different settling times when the sedimentation medium is at 25° C. The diameters indicated are strictly theoretical and are therefore only useful in the type of controlled test described herein.

After the various settling times have been determined, obtain from the height percent table and appropriate time-diameter table the values represented by each millimetre of abrasive grain collected. Then plot an accumulation curve with micrometer size as the abscissa and height percent as the ordinate. On the same graph and in the same way, plot from the 3% point to the 50% point the standard accumulation curve for the abrasive grain being tested as given in Figure 1.

Initial Point Expectations:

Sampling of a coated abrasive and the recovery of the mineral therefore may not detect the largest mineral in a particular lot. The procedure for sedimentation calls for the timing to begin at the point when the first steady stream of abrasive grain particles arrives at the bottom of the collecting tube. It is expected that the initial point will be as much as 1.5 times the 3% point of the accumulation curve measured. The factor ranges from 1.1 at the 240 end of the series to 1.5 at the 600 end of the series. The following is approximate and is intended to be informative rather than a binding control.

Sedimentation time-diameter tables for temperatures of the sedimentation medium other than 25° C may be computed by means of the following procedure which was used in preparing Tables 9, 10, 11, and 12.

$$D = \frac{K}{\sqrt{T}} \qquad \text{Eq 6)}$$

Grit Size	Average Value at 3%		
	Micrometers x	Factors	Micron
240	77.75	1.15 or	89.4
280	71.25	1.15	81.9
320	60.75	1.21	73.5
360	48.50	1.31	63.5
400	38.50	1.42	54.7
500	33.30	1.50	50.0
600	30.50	1.50	45.8

Table 8 - Accumulated Height Percent

Height	Total Height Level of Collected (Sedimented) Abrasive Grain in Millimetres										
Sedimented mm	20	20 ½	21	21 ½	22	22 ½	23	23 ½	24	24 ½	25
1	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.3	4.2	4.1	4.0
2	10.0	9.8	9.5	9.3	9.1	8.9	8.7	8.5	8.3	8.2	8.0
3	15.0	14.6	14.3	14.0	13.6	13.3	13.0	12.8	12.5	12.3	12.0
4	20.0	19.5	19.0	18.6	18.2	17.8	17.4	17.0	16.7	16.3	16.0
5	25.0	24.4	23.8	23.3	22.7	22.2	21.7	21.3	20.8	20.4	20.0
6	30.0	29.3	28.6	27.9	27.3	26.7	26.1	25.5	25.0	24.5	24.0
7	35.0	34.1	33.3	32.6	31.8	31.1	30.4	29.8	29.2	28.6	28.0
8	40.0	39.0	38.1	37.2	36.4	35.6	34.8	34.0	33.3	32.7	32.0
9	45.0	43.9	42.9	41.9	40.9	40.0	39.1	38.3	37.5	36.7	36.0
10	50.0	48.8	47.6	46.5	45.5	44.4	43.5	42.6	41.7	40.8	40.0
11	55.0	53.7	52.4	51.2	50.0	48.9	47.8	46.8	45.8	44.9	44.0
12	60.0	58.5	57.1	55.8	54.5	53.3	52.2	51.1	50.0	49.0	48.0
13	65.0	63.4	61.9	60.5	59.1	57.8	56.5	55.3	54.2	53.1	52.0
14	70.0	68.3	66.7	65.1	63.6	62.2	60.9	59.6	58.3	57.1	56.0
15	75.0	73.2	71.4	69.8	68.2	66.7	65.2	63.8	62.5	61.2	60.0
16	80.0	78.0	76.2	74.4	72.7	71.1	69.6	68.1	66.7	65.3	64.0
17	85.0	83.0	81.0	79.1	77.3	75.6	73.9	72.3	70.8	69.4	68.0
18	90.0	87.8	85.7	83.7	81.8	80.0	78.3	76.6	75.0	73.5	72.0
19	95.0	92.7	90.5	88.4	86.4	84.4	82.6	80.8	79.2	77.6	76.0
20	-	97.6	95.2	93.0	90.9	88.9	87.0	85.1	83.3	81.6	80.0
21	-	-	-	97.7	95.5	93.3	91.3	89.4	87.5	85.7	84.0
22	-	-	-	-	-	97.8	95.7	93.6	91.7	89.8	88.0
23	-	-	-	-	-	-	-	97.9	95.8	93.9	92.0
24	-	-	-					-	-	98.0	96.0

Table 9 - Sedimentation Time-Diameter Values for Aluminum Oxide at 25°C

Time Minutes	Diam. Micrometers	Time Minutes	Diam. Micrometers	Time Minutes	Diam. Micrometers	Time Minutes	Diam. Micrometers
0.50	112.7	3.00	46.0	6.00	32.5	17.00	19.3
.55	107.5	.05	45.6	.10	32.3	.50	19.0
.60	102.9	.10	45.3	.20	32.0	18.00	18.8
.65	98.9	.15	44.9	.30	31.8	.50	18.5
.70	95.3	.20	44.6	.40	31.5	19.00	18.3
0.75	92.0	3.25	44.2	6.50	31.3	.50	18.0
.80	89.1	.30	43.9	.60	31.0	20.00	17.8
.85	86.4	.35	43.5	.70	30.8	.50	17.6
.90	84.0	.40	43.2	.80	30.6	21.00	17.4
.95	81.8	.45	42.9	.90	30.3	22.00	17.0
1.00	79.7	3.50	42.6	7.00	30.1	23.00	16.6
.05	77.8	.55	42.3	.10	29.9	24.00	16.3
.10	76.0	.60	42.0	.20	29.7	25.00	15.9
.15	74.3	.65	41.7	.30	29.5	26.00	15.6
.20	72.8	.70	41.4	.40	29.3	27.00	15.3
1.25	71.3	3.75	41.2	7.50	29.1	28.00	15.1
.30	69.9	.80	40.9	.60	28.9	29.00	14.8
.35	68.6	.85	40.6	.70	28.7	30.00	14.6
.40	67.4	.90	40.4	.80	28.5	32.00	14.1
.45	66.2	.95	40.1	.90	28.4	34.00	13.7
4.50	65.1	4.00	39.8	8.00	28.2	36.00	13.3
.55	64.0	.05	39.6	.20	27.8	38.00	12.9
.60	63.0	.10	39.4	.40	27.5	40.00	12.6
.65	62.0	.15	39.1	.60	27.2	42.00	12.3
.70	61.1	.20	38.9	.80	26.9	44.00	12.0
1.75	60.2	4.25	38.7	9.00	26.6	46.00	11.8
.80	59.4	.30	38.4	.20	26.3	48.00	11.5
.85	58.6	.35	38.2	.40	26.0	50.00	11.3
.90	57.8	.40	38.0	.60	25.7	55.00	10.8
.95	57.1	.45	37.8	.80	25.5	60.00	10.3
2.00	56.4	4.50	37.6	10.00	25.2		
.05	55.7	.55	37.4	.20	25.0		
.10	55.0	.60	37.2	.40	24.7		
.15	54.4	.65	37.0	.60	24.5		
.20	53.7	.70	36.8	.80	24.2		
2.25	53.1	4.75	36.6	11.00	24.0		
.30	52.6	.80	36.4	.20	23.8		
.35	52.0	.85	36.2	.40	23.6		
.40	51.4	.90	36.0	.60	23.4		
.45	50.9	.95	35.8	.80	23.2		
2.50	50.4	5.00	35.6	12.00	23.0		
.55	49.9	.10	35.3	.50	22.5		
.60	49.4	.20	35.0	13.00	22.1		
.65	49.0	.30	34.6	.50	21.7		
.70	48.5	.40	34.3	14.00	21.3		
2.75	48.1	5.50	34.0	.50	20.9		
.80	47.6	.60	33.7	15.00	20.6		
.85	47.2	.70	33.4	.50	20.2		
.90	46.8	.80	33.1	16.00	19.9		
.95	46.4	.90	32.8	.50	19.6		

Table 10 - Sedimentation Time-Diameter Values for Silicon Carbide at 25°C

Time Minutes	Diam. Micrometers	Time Minutes	Diam. Micrometers	Time Minutes	Diam. Micrometers	Time Minutes	Diam. Micrometers
0.50	128.8	3.00	52.6	6.00	37.2	17.00	22.1
.55	122.8	.05	52.2	.10	36.9	.50	21.8
.60	117.6	.10	51.7	.20	36.6	18.00	21.5
.65	112.9	.15	51.3	.30	36.3	.50	21.2
.70	108.8	.20	50.9	.40	36.0	19.00	20.9
.75	105.1	3.25	50.5	6.50	35.7	.50	20.6
.80	101.8	.30	50.2	.60	35.5	20.00	20.4
.85	98.8	.35	49.8	.70	35.2	.50	20.1
.90	96.0	.40	49.4	.80	34.9	21.00	19.9
.95	93.4	.45	49.0	.90	34.7	22.00	19.4
1.00	91.1	3.50	48.7	7.00	34.4	23.00	19.0
.05	88.9	.55	48.4	.10	34.2	24.00	18.6
.10	86.9	.60	48.0	.20	34.0	25.00	18.2
.15	85.0	.65	47.7	.30	33.7	26.00	17.9
.20	83.2	.70	47.4	.40	33.5	27.00	17.5
1.25	81.5	3.75	47.0	7.50	33.3	28.00	17.2
.30	79.9	.80	46.7	.60	33.0	29.00	16.9
.35	78.4	.85	46.4	.70	32.8	30.00	16.6
.40	77.0	.90	46.1	.80	32.6	32.00	16.1
.45	75.6	.95	45.8	.90	32.4	34.00	15.6
1.50	74.4	4.00	45.6	8.00	32.2	36.00	15.2
.55	73.2	.05	45.3	.20	31.8	38.00	14.8
.60	72.0	.10	45.0	.40	31.4	40.00	14.4
.65	70.9	.15	44.7	.60	31.1	42.00	14.0
.70	69.9	.20	44.4	.80	30.7	44.00	13.7
1.75	68.9	4.25	44.2	9.00	30.4	46.00	13.4
.80	67.9	.30	43.9	.20	30.0	48.00	13.1
.85	67.0	.35	43.7	.40	29.7	50.00	12.9
.90	66.1	.40	43.4	.60	29.4	55.00	12.3
.95	65.2	.45	43.2	.80	29.1	60.00	11.8
2.00	64.4	4.50	42.9	10.00	28.8		
.05	63.6	.55	42.7	.20	28.5		
.10	62.9	.60	42.5	.40	28.2		
.15	62.1	.65	42.2	.60	28.0		
.20	61.4	.70	42.0	.80	27.7		
2.25	60.7	4.75	41.8	11.00	27.5		
.30	60.1	.80	41.6	.20	27.2		
.35	59.4	.85	41.4	.40	27.0		
.40	58.8	.90	41.2	.60	26.7		
.45	58.2	.95	40.9	.80	26.5		
2.50	57.6	5.00	40.7	12.00	26.3		
.55	57.0	.10	40.3	.50	25.8		
.60	56.5	.20	40.0	13.00	25.3		
.65	56.0	.30	39.6	.50	24.8		
.70	55.4	.40	39.2	14.00	24.3		
2.75	54.9	5.50	38.8	.50	23.9		
.80	54.4	.60	38.5	16.00	23.5		
.85	54.0	.70	38.2	.50	23.1		
.90	53.5	.80	37.8		22.8		
.95	53.0	.90	37.5		22.4		

Table 11 - Sedimentation Time-Diameter Values for Garnet at 25° C

Time	Diam.	Time	Diam.	Time	Diam.	Time	Diam.
Minutes	Micrometers	Minutes	Micrometers	Minutes	Micrometers	Minutes	Micrometers
0.50	114.7	3.00	46.8	6.00	33.1	17.0	19.7
.55	109.4	.05	46.4	.10	32.8	.50	19.4
.60	104.7	.10	46.1	.20	32.6	18.00	19.1
.65	100.6	.15	45.7	.30	32.3	.50	18.8
.70	69.9	.20	45.3	.40	32.0	19.00	18.6
0.75	93.6	3.25	45.0	6.50	31.8	.50	18.4
.80	90.7	.30	44.6	.60	31.6	20.00	18.1
.85	88.0	.35	44.3	.70	31.3	.50	17.9
.90	85.5	.40	44.0	.80	31.1	21.00	17.6
.95	83.2	.45	43.7	.90	30.9	22.00	17.3
1.00	81.1	3.50	43.4	7.00	30.6	23.00	16.9
.05	79.2	.55	43.0	.10	30.4	24.00	16.6
.10	77.3	.60	42.7	.20	30.2	25.00	16.2
.15	75.6	.65	42.5	.30	30.0	26.00	15.9
.20	74.0	.70	42.2	.40	29.8	27.00	15.6
1.25	72.5	3.75	41.9	7.50	29.6	28.00	15.3
.30	71.1	.80	41.6	.60	29.4	29.00	15.1
.35	69.8	.85	41.3	.70	29.2	30.00	14.8
.40	68.5	.90	41.1	.80	29.0	32.00	14.3
.45	67.4	.95	40.8	.90	28.8	34.00	13.9
1.50	66.2	4.00	40.6	8.00	28.7	36.00	13.5
.55	65.1	.05	40.3	.20	28.3	38.00	13.2
.60	64.1	.10	40.0	.40	28.0	40.00	12.8
.65	63.1	.15	39.8	.60	27.6	42.00	12.5
.70	62.2	.20	39.6	.80	27.3	44.00	12.2
1.75	61.3	4.25	39.3	9.00	27.0	48.00	11.7
.80	60.4	.30	39.1	.20	26.7	50.00	11.5
.85	59.6	.35	38.9	.40	26.4	55.00	10.9
.90	58.8	.40	38.7	.60	26.2	60.00	10.5
.95	58.1	.45	38.4	.80	25.9		
2.00	57.3	4.50	38.2	10.00	25.6		
.05	56.6	.55	38.0	.20	25.4		
.10	56.0	.60	37.8	.40	25.1		
.15	55.3	.65	37.6	.60	24.9		
.20	54.7	.70	37.4	.80	24.7		
2.25	54.1	4.75	37.2	11.00	24.4		
.30	53.5	.80	37.0	.20	24.2		
.35	52.9	.85	36.8	.40	24.0		
.40	52.4	.90	36.6	.60	23.8		
.45	51.8	.95	36.4	.80	23.6		
2.50	51.3	5.00	36.3	12.00	23.4		
.55	50.8	.10	35.9	.50	22.9		
.60	50.3	.20	35.6	13.00	22.5		
.65	49.8	.30	35.2	.50	22.1		
.70	49.4	.40	34.9	14.00	21.7		
2.75	48.9	5.50	34.6	.50	21.3		
.80	48.5	.60	34.3	15.00	21.0		
.85	48.0	.70	34.0	.50	20.6		
.90	47.6	.80	33.7	16.00	20.3		
.95	47.2	.90	33.4	.50	20.0		

Table 12 - Sedimentation Time-Diameter Values for Flint at 25°C

Time Minutes	Diam. Micrometers	Time Minutes	Diam. Micrometers	Time Minutes	Diam. Micrometers	Time Minutes	Diam. Micrometers	Time Minutes	Diam. Micrometers
0.50	148.9	2.90	61.8	5.30	45.7	9.30	34.5	34.00	18.0
.55	141.9	.95	61.3	.35	45.3	.40	34.3	35.00	17.8
.60	135.9	3.00	60.8	.40	45.3	9.50	34.2	36.00	17.6
.65	130.6	.05	60.3	.45	45.1	.60	34.0	37.00	17.3
.70	125.8	.10	59.8	5.50	44.9	.70	33.8	38.00	17.1
0.75	121.5	.15	59.3	.55	44.7	.80	33.6	39.00	16.9
.80	117.7	.20	58.9	.60	44.5	.90	33.5	40.00	16.6
.85	114.2	3.25	58.4	.65	44.3	10.00	33.3	41.00	16.4
.90	111.0	.30	58.0	.70	44.0	.20	33.0	42.00	16.2
.95	108.0	.35	57.5	5.75	43.9	.40	32.6	43.00	16.1
1.00	105.3	.40	57.1	.80	43.7	.60	32.3	44.00	15.9
.05	102.7	.45	56.7	.85	43.5	.80	32.0	45.00	15.7
.10	100.4	3.50	56.3	.90	43.4	11.00	31.7	46.00	15.5
.15	98.2	.55	55.9	.95	43.2	.20	31.5	47.00	15.4
.20	96.1	.60	55.5	6.00	43.0	.40	31.2	48.00	15.2
1.25	94.2	.65	55.1	.05	42.8	.60	30.9	49.00	15.0
.30	92.4	.70	54.7	.10	42.6	.80	30.6	50.00	14.9
.35	90.6	3.75	54.4	.20	42.3	12.00	30.4	55.00	14.2
.40	89.0	.80	54.0	.30	4.0	.50	29.8	60.00	13.6
.45	87.4	.85	53.7	.40	41.6	13.00	29.2	65.00	13.1
1.50	86.0	.90	53.3	6.50	41.3	.50	28.6	70.00	12.6
.55	84.6	.95	53.0	.60	41.0	14.00	28.1	75.00	12.2
.60	83.2	4.00	52.6	.70	40.7	.50	27.6	80.00	11.8
.65	82.0	.05	52.3	.80	40.4	15.00	27.2	85.00	11.4
.70	80.8	.10	52.0	.90	40.1	.50	26.7	90.00	11.1
1.75	79.6	.15	51.7	7.00	39.8	16.00	26.3	95.00	10.8
.80	78.5	.20	51.4	.10	39.5	.50	25.9	100.00	10.5
.85	77.4	4.25	51.1	.20	39.2	17.00	25.5	110.00	10.0
.90	76.4	.30	50.8	.30	39.0	.50	25.2	120.00	9.6
.95	75.4	.35	50.5	.40	38.7	18.00	24.8	130.00	9.2
2.00	74.4	.40	50.2	7.50	37.4	.50	24.5	140.00	8.9
.05	73.5	.45	49.9	.60	38.2	19.00	24.2	150.00	8.6
.10	72.7	4.50	49.6	.70	37.9	.50	23.8	160.00	8.3
.15	71.8	.55	49.4	.80	37.7	20.00	23.5		
.20	71.0	.60	49.1	.90	37.5	.50	23.2		
2.25	70.2	.65	48.8	8.00	37.2	21.00	23.0		
.30	69.4	.70	48.6	.10	37.0	22.00	22.4		
.35	68.7	4.75	48.3	.20	36.8	23.00	22.0		
.40	68.0	.80	48.1	.30	36.6	24.00	21.5		
.45	67.3	.85	47.8	.40	36.3	25.00	21.1		
2.50	66.6	.90	47.6	8.50	36.1	26.00	20.6		
.55	65.9	.95	47.3	.60	35.9	27.00	20.3		
.60	65.3	5.00	47.1	.70	35.7	28.00	19.9		
.65	64.7	.05	46.8	.80	35.5	29.00	19.6		
.70	64.1	.10	46.6	.90	35.3	30.00	19.2		
2.75	63.5	.15	46.4	9.00	35.1	31.00	18.9		
.80	62.9	.20	46.2	.10	34.9	32.00	18.6		
.85	62.4	5.25	46.0	.20	34.7	33.00	18.3		

Where: D = Diameter in micrometers
T = Settling time in minutes

Since T is in minutes, at one minute

D = K = 91.1 for silicon carbide
= 79.7 for aluminum oxide
= 81.1 for garnet
= 105.3 for flint

Calculation of K: $\sqrt{\frac{9nL}{2g(p-d)60}}$ (Eq 7)

K = 20,000

Where:
n = 0.00656 at 25°
L = 100
g = 980
p = 3.22 for silicon carbide
= 3.96 for aluminum oxide
= 3.85 for garnet
= 2.61 for flint
d = 0.800 at 25° C

At other settling medium temperatures between 20° and 30°, the 25° C value of K may be corrected as follows:

K for silicon carbide = 109.6 - 0.741 x t
K for aluminum oxide = 96.16 - 0.657 x t
K for garnet = 98.0 - 0.675 x t
K for flint = 127.1 - 0.871 x t

Where t = Temperature in degrees Celsius

6.3 Electrical Resistance Method for Testing Microgrits (Figure 5)

Classification - Testing Method by Electric Resistance (this method applies to fine grit sizes 600 and finer).

6.3.1 Basic Theory of Electric Resistance Test Method

The Electric Resistance Test Method determines the number and size of particles suspended in an electrically conductive liquid. This is done by forcing the suspension to flow through a small aperture having an immersed electrode on either side.

As a particle passes through the aperture, it changes the resistance between the electrodes. This produces a voltage pulse of short duration having a magnitude proportional to particle size. The series of pulses is then electronically scaled and counted.

6.3.2 Samples

Samples shall be taken according to ASTM or Standard Acceptable Industrial Methods, Methods for Sampling of Abrasive Grains for bulk abrasive grains or by the standard stated method for recovered grains.

6.3.3 Test Method:

6.3.3.1 Apparatus and Calibration of Samples

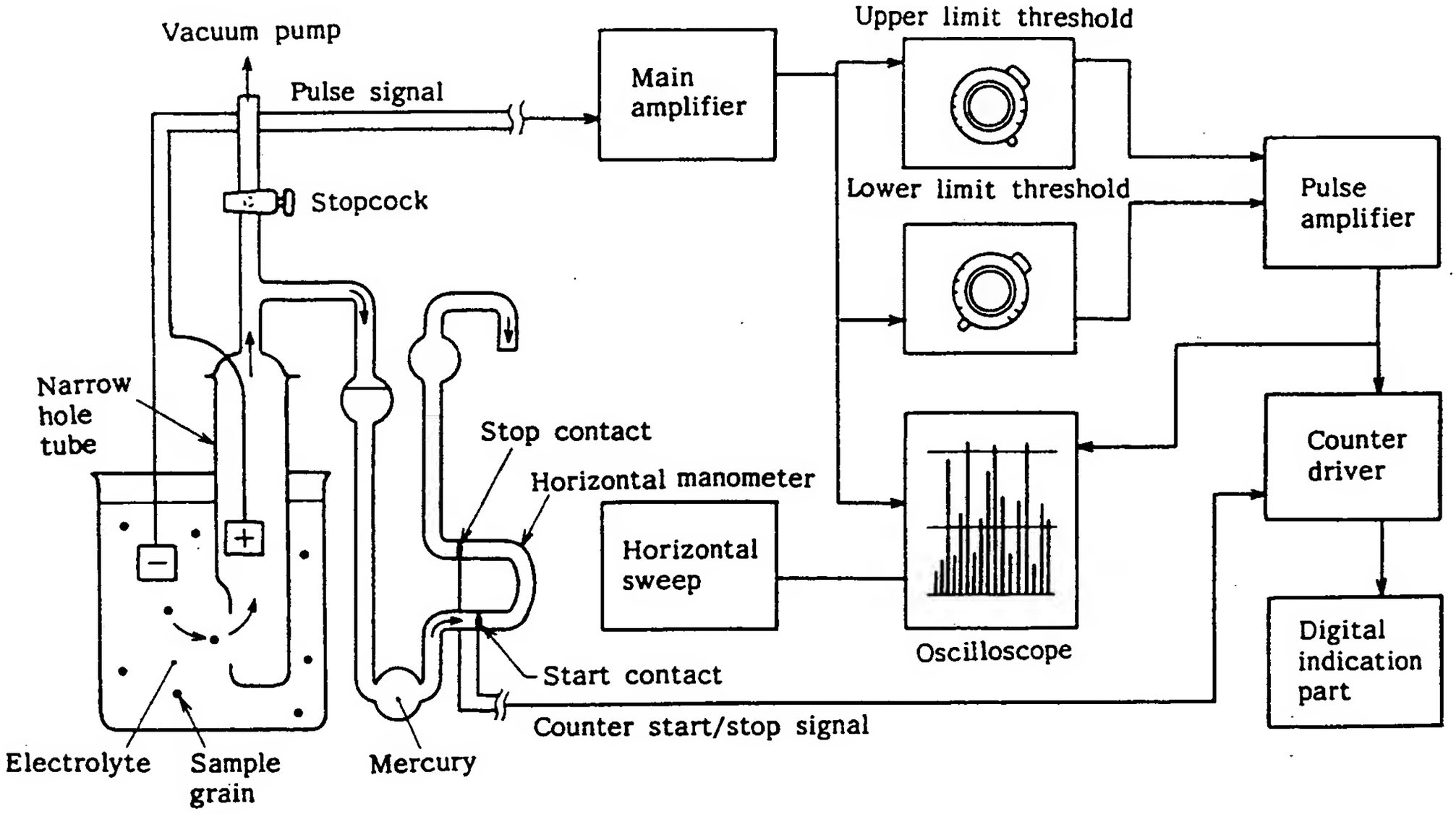
6.3.3.1.1 Apparatus

The apparatus shall be as shown in Figure 5.

6.3.3.1.2 Aperture Tube

The tube to be used for measurement shall have the aperture opening diameter given in Table 13.

Fig. 5 Example of Apparatus for Method for Testing Electric Resistance



6.3.3.1.3 Electrolyte

An electrolyte shall be used as the dispersing agent of a sample. The electrolyte shall be sodium chloride of 1% to 4% concentration or sodium pyrophosphate solution of 4% concentration and filtered. When an aperture tube larger than 50 μm is used, two times through a filter of 0.2 μm. Other commercially made electrolytes may also be used as defined by the equipment manufacturer.

6.3.3.1.4 Calibration Sample

Latex spheres similar to the true sphere of which the grain size distribution is known shall be used for the calibration of the apparatus. These are available from the instrument manufacturer.

6.3.4 Calibration of Apparatus

The apparatus shall be calibrated with a calibration sample. After setting up the apparatus to measure a sample, the suction pressure is regulated near 160 mmHg. Then, for each aperture tube used for measurement, the measuring conditions shall be determined on the basis of the calibration procedure of the apparatus using a calibrated sample. A calibrated sample which is 4% to 10% of the aperture opening diameter shall be used.

6.3.5 Aperture Tube Application

Aperture tubes used for measurement are defined in Table 14.

6.3.6 Operation

The electric resistance test shall be run as follows:

6.3.6.1 Turn on the power supply and check the apparatus to make sure all of the components are operating properly.

6.3.6.2 Attach the aperture tube to the sample stand and fill the inside of the tube with electrolyte.

6.3.6.3 Put approximately 0.5 g of sample into a beaker and add 100 ml of electrolyte.

6.3.6.4 Use an ultrasonic cleaner to disperse the sample liquid for approximately 1 to 3 minutes with a frequency of approximately 28 kHz.

6.3.6.5 Place the sample beaker filled with the electrolyte on the sample stand and position the stirrer rod where it will not contact the aperture tube or the electrode.

6.3.6.6 While stirring continuously with a 5 ml. pipette by hand, draw out a dispersed sample and drip it into the other beaker containing only electrolyte. Control the amount of the sample added so as not to exceed the limit listed in Table 14 to minimize the occurrence of multiple particles simultaneously passing through the aperture.

6.3.6.7 Increase the stirrer speed to keep the particles suspended, but slow enough to prevent air bubbles from forming in the electrolyte and the electrode from vibrating.

6.3.6.8 Gently open the stopcock of the

Table 13 - Application Division of Aperture Tube

Unit: μm

Grain Size	#240 to #400	#500 to #800	#1000 to #2000	#2500 to #4000	#6000 to #8000
Aperture Diameter	560 to 380	240 to 190	120 to 95	76 to 48	24 to 10

Table 14 - Upper Limit Value of Measuring Speed to Minimize Simultaneous Particle Passage

Grain Size	#240 to #400	#500 to #800	#1000 to #2000	#2500 to #4000	#6000 to #8000
Measuring upper limit value	230	800	1500	3500	6000

Table 15 - Lower Limit Value of Measuring Number by Individual Grain Sizes

Grain Size	#240 to #400	#500 to #800	#1000 to #2000	#2500 to #4000	#6000 to #8000
Lower limit value of measuring number	20000	30000	50000	100000	100000

sample stand and allow the electrolyte to be drawn through the aperture tube. Refer to Figures 1 & 4 for acceptable limits.

6.3.6.9 Turn on the counter and count the particles. Make sure that the particle count is greater than the lower limit values given in Table 15.

6.3.6.10 Record the cumulative value of the volume distribution of grains and the central value of the channel containing the maximum grain and take the latter as the maximum grain diameter.

6.3.7. Calculation

6.3.7.1 Plot the cumulative values of volume distribution on the ordinate axis of a normal probability paper and the grain sizes on the abscissa of the paper. Plot the measured values obtained in the 4.0 (10) on the paper and connect those points with straight lines.

6.3.7.2. Read the grain sizes corresponding to 3, 50, and 94 percent.

6.3.7.3. Obtain the midpoint diameter of the channel containing the maximum size grain.

6.3.8. Report

Report the maximum grain size and the grain sizes corresponding to 3, 50, and 94 percent in cumulative values of volume distribution.

7 Ro-Tap Screen Grading

Grains of Fused Aluminum Oxide, Silicon Carbide, Zirconia-Alumina and Garnet for Coated Abrasives Products Testing of Macrogrits 12 to 220.

7.1 Field of Application

This standard applies to the testing of macrogrits 12 to 220 grains of fused aluminum oxide, silicon carbide, zirconia-alumina and garnet according to the RO-TAP method. This standard is applicable both to the abrasive grain as supplied for the manufacture of coated abrasive products and to the abrasive grain recovered from the coated abrasive product for testing purposes.

7.1.1 Macrogrits

Macrogrits are defined as those grits whose grain size distribution is determined by means of sieving, i.e., by residues on or grains passing through the test sieves corresponding to the nest of sieves shown in Table 5A.

In the case of internal operational tests, the macrogrits are determined on common use test sieves by comparative sieving with CAMI Standard Sands.

7.1.2 Test Sieves

Sieves (Table 5A of this Standard) are test sieves for the internal operational testing of macrogrits for coated abrasives products. They must achieve reproducible test results in the test with CAMI Standard Sands.

For the assessment of the sieving results the values from testing with test sieves must be related to the CAMI Standard values resulting from the

testing with reference sieves in Table 5A.

7.2 Testing by Sieving

The testing of macrogrits 12 to 220 is carried out by comparative sieving of the CAMI Standard Sand and sample on common use test sieves.

The size distribution of the abrasive grain sample is to be determined according to the method described in this Standard by comparative sieving of the standard sand and abrasive grain sample each on the same nest of test sieves.

7.3 Test Apparatus and Auxiliary Devices

7.3.1 Test Sieving Machine

The test shall only be carried out with test sieving machines giving reproducible and comparable results, e.g., RO-TAP Test Sieving Machines.

7.3.2 Time Switch

A time switch shall be used to control the test sieving machine for a period of 5 minutes.
The permissible accuracy shall be +/- 5 seconds.

7.3.3 Test Sieves

The equivalent Test Sieves given in Table 5A shall be used.

The checking of the serviceability of the test sieves is described in Paragraph 7.5.

7.3.4 Balance

Only balances with an accuracy of +/- 0.1 g shall be used.

7.3.5 CAMI Standard Sands

The CAMI Standard Sands represent the reference for the grain size testing for coated abrasives products.

Each supply of CAMI Standard Sand shall be an approved CAMI Standard. (Refer to 3.2.5.)

7.4 Checking of the Test Sieves

Sieves must be free from visible defects such as textural flaws (gaps, broken wires, etc.), insufficient tension of the fabric, distortions of the frame (out of roundness, leaks and soldering defects) and free from blinding as these will impair the sieving results.

CAMI Standard Sands are to be used for checking the serviceability of these test sieves within the meaning of this standard.

The control test sieve to be tested shall be mounted into the respective nest of sieves as the 3rd sieve. The 1st sieve and the 2nd sieve must be checked sieves. The residue on the 3rd sieve shall not deviate from the CAMI Standard Sand analysis value as given by the tolerance according to Table 5A.

After this test, a sieve is considered as not suitable if the residues on the 3rd sieve exceeds the permissible deviations of Table 5A.

7.5 Test Sieving

7.5.1 Preparation

7.5.1.1 Preparation of the Sample

The abrasive grit to be tested must be dry. If it is wet, it must be dried at a temperature of 105 degrees C until its weight remains constant.

100 g of the dry abrasive shall be weighed out as sample for test sieving. In the case of grains recovered from the coated abrasive product, the sample shall never be less than 20 g.

7.5.1.2 Mounting of Test Sieves

The test sieves, see Table 5A, required for testing the respective grain size shall be assembled together with the bottom pan to form a nest of sieves taking into account the prescribed order. The sample shall be poured onto the first test sieve and the cover put on. Then the nest of sieves shall be mounted in the test sieving machine. The tapper shall be placed on the cover of the nest of test sieves.

7.5.1.3 Determination of the CAMI Standard Sand Values for the Test Sieving

Because of the unavoidable deviations between test sieves of the same designation, it is necessary to carry out a first sieving with standard sand on the sieves to be used to determine the values of the standard sand.
For this purpose, 100 g of standard sand of the same grain size shall be weighed out and transferred to test sieve 1. The test sieving machine shall be run for 5 minutes by setting the time switch accordingly.

After the sieving is completed the residues on the sieves shall be transferred individually to the balance pan and weighed, beginning with the residue on the coarsest test sieve. The residue on the bottom pan shall also be weighed.

7.5.2 Test Sieving Procedure

100 g of the abrasive grain to be tested shall be weighed out as sample and transferred to test sieve 1. The sieving procedure shall be the same as described for the standard sand.

If grains recovered from the coated abrasive product are to be tested, the quantity of the sample shall be not less than 20 g.

The sieving result shows the grain size distribution of the sample.

7.6 Evaluation (Refer to Section 4).

8 Ro-Tap Testing Machine

8.1 Field of Application

This supplement describes test sieving machines for determining the size distribution of abrasive grits of fused aluminum oxide, silicon carbide, zirconia-alumina and garnet to be used for coated abrasive products.

8.2 Assembly of Test Sieving Machines

The uniform mechanical and reproducible testing of abrasive grits by means of sieving is only possible if the test sieving machines used correspond exactly with regard to their function and the test sieves used.

Test sieving machines consist for example of the following components (see also figures 6 and 7):
-support and frame
-electric motor
-gear drive for the conversion of the rotary motion of motor into the specified eccentric rotary motion of the nest of sieves and into the tapping action.
-switch which is actuated by means of a time switch
-tapper for the execution of the strokes specified for the given unit of time, on the cover of the nest of sieves in vertical direction.
-retainer for bottom pan and nest of sieves in which it is possible for them to move in the specified manner.
-Cover for the sieves with funnel-shaped insert with plug (cork).

In addition, the following is necessary for the operation of test sieving machines:

-base plate
-test sieve (nest of 4 sieves)
-bottom pan

8.3 Functioning of Test Sieving Machines

Under defined conditions mechanical test sieving reproduces manual sieving. The results furnished by mechanical sieving must be reproducible for repetition of the sieving procedure.

8.4 Nests of Test Sieves and Sieve Frames

The nest of test sieves is mounted in the sieving machines in such a way that the prescribed movements are possible without any obstruction. Attention is to be paid to the recommendations of the manufacturer.

The sieve frames of the test sieves have the following dimensions:

-diameter 200 mm
-height- 50 mm

For each grit, the nest of test sieves specified in the respective standards is to be used.

8.5 Sieving Time

The test sieving machines shall be provided with a time switch in order to guarantee that the prescribed sieving time is kept.

8.6 Installation of Test Sieving Machines

The test sieving machine shall be fixed on a suitable base block of sufficient mass in such a way that external vibrations cannot reach the machine.

The standard assembly of the RO-TAP test sieving machine type A is defined as the fixing of the sieving machine on a concrete block of at least 625 mm in width, a depth of 500 mm and a height of 550 mm.

For the design of the concrete block, as well as for the arrangement of the fastening screws, see figure 8. The concrete block shall be placed on a vibration absorbing board, e.g., of hard felt, which can also compensate for unevenness of the ground.

The ground should be free from vibrations, i.e., it should be natural soil.

Where it is not possible to meet this requirement, the RO-TAP test sieving machine should be placed in such a way that the forces and moments occurring during the operation of the machine be transmitted due to the load bearing construction to foundation walls.

The test sieving machine must be placed horizontally.

If an acoustic cabinet is used, it shall be attached neither to the sieving machine nor the concrete block.

8.7 Checking of the Test Sieving Machines

The efficiency of the test sieving machines shall be checked at appropriate intervals especially the performance of the tapper and the precision of the time switch.

8.8 Maintenance of Test Sieving Machines

In order to maintain the efficiency and operational reliability of the test sieving machines, it is recommended that the manufacturer's instructions concerning maintenance are adhered to.

In order to achieve reproducible sieving results, it is necessary to observe the respective operating instructions for RO-TAP test sieving machines type A and B.

When putting the nest of test sieves in type A, the bottom plate shall be lifted in such a way that the distance between the cover and the fixing clamp in the upper rail is 1.5 mm.

The bottom plate shall be clamped in this position.

APPENDIX 1
PARTICLE SIZE DISTRIBUTION VALUES
ELECTRICAL RESISTANCE METHOD

ANSI	3% maximum	50%	95% minimum
600	29.7	14.3-16.3	10.2
800	20.0	10.5-12.5	8.0
1000	16.0	8.7-10.3	6.0
1500	15.0	7.4-8.6	4.5
2000	13.0	6.7-7.7	4.0
2500	11.0	5.0-6.0	3.0
3000	10.0	3.5-4.5	2.0
4000	8.0	2.6-3.4	1.3
6000	5.0	1.6-2.4	0.8
8000	3.5	0.9-1.5	0.6